TECHNICAL REPORT

ENERGY SUBSIDY REFORM IN ACTION

DISTRIBUTIONAL ANALYSIS FOR INFORMING ENERGY SUBSIDY REFORMS

Review of Recent Approaches

ESMAP
Energy Sector Management Assistance Program

THE WORLD BANK
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Anne Olivier, Mikhail Matytsin, and Defne Gencer

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ABOUT ESMAP

The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and over 20 partners to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the WB, ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG7), which ensures access to affordable, reliable, sustainable, and modern energy for all. It helps shape WB strategies and programs to achieve the WB Climate Change Action Plan targets. Learn more at: https://www.esmap.org.

ABOUT THIS SERIES

This report is part of the "Energy Subsidy Reform in Action" series produced by the ESMAP Energy Subsidy Reform Facility, with the objective of drawing insights from recent experiences and emerging approaches related to reform of energy subsidies in developing countries. The series includes issue-specific reports from various relevant domains such as energy sector reform, macroeconomic and fiscal policy, carbon pricing, poverty and distributional analysis, social protection, political economy, and communications.

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Contents

List of Figures, Tables, and Boxes

Figures

Tables

Boxes

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The report's main technical content related to poverty and distributional analysis and case studies was prepared by Anne Olivier (Consultant, Poverty and Equity GP, and ESMAP, World Bank) and Mikhail Matytsin (Data Scientist, Poverty and Equity GP), while Defne Gencer (Senior Energy Specialist, ESMAP) contributed to content on energy sector dimensions, practical and policy implications, and overall messaging. Sherrie Brown provided editing services and Laura Johnson was responsible for report design.

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Executive Summary

With limited fiscal space for poverty reduction and social protection, countries are exploring ways to provide support to poor and vulnerable people in an efficient and effective way. In recent years, governments have increasingly been considering the replacement of energy subsidies delivered through energy prices with targeted cash transfers to select end users. Globally, energy subsidies were estimated at US$531 billion in 2021, and exceeded US$1 trillion in 2022,[1] with country-level spending on energy subsidies often exceeding allocations for social assistance. Energy subsidies are very costly—government spending to subsidize fossil fuels, heating, or electricity can put significant pressure on a country's fiscal balance, consuming scarce fiscal resources that could otherwise be used for pro-poor public spending. By distorting price signals, subsidies lead to overuse of the subsidized fuels and reduce incentives for energy conservation and investment in energy efficiency and cleaner energy alternatives, and thereby undermine climate change mitigation efforts. Much evidence indicates that energy subsidies tend to be regressive, often disproportionately benefiting higher-income households.[2] As countries explore ways to address the fiscal burden, opportunity costs, and regressive incidence of energy subsidies, they are increasingly focusing on creating, strengthening, or expanding social protection mechanisms to support people most in need. However, developing the ability to make such transitions and deliver solutions that meet key government objectives involves significant effort and requires key steps such as understanding subsidies and their reform; planning, financing, and implementing social protection measures; and at the same time being mindful of political economy constraints.

Any effort to reform energy subsidies or design new mechanisms should begin with a careful assessment of the distributional impacts of energy subsidies, their reform, and potential mitigation mechanisms. The specific role of distributional analysis in a comprehensive approach to subsidy reform is to identify the reform's potential impact on different segments of the population, especially the poor and vulnerable. Indeed, the removal of energy subsidies can have significant impacts on low-income households that rely on these subsidies to access and consume energy services, even though these subsidies may disproportionally benefit higher-income households. Distributional analysis helps

[1] According to the International Energy Agency (IEA) Database (2022), fossil fuel consumption subsidies in 2021 were rising back to 2018 levels as energy prices rose with the rebound of the global economy. (See appendix A for the evolution of global fossil fuel subsidies as well as for selected countries from 2010 to 2021.) Preliminary estimates for 2022 indicate that they doubled between 2021 and 2022 (https://www.iea.org/commentaries/the-global-energy-crisis-pushed-fossil-fuel-consumption-subsidies-to-an-all-time-high-in-2022). Following the war in Ukraine and growing political conflicts with the Russian Federation, oil and gas prices increased significantly in 2022 (World Bank 2022).

[2] Arze del Granado, Coady, and Gillingham (2012) show that, among 20 developing countries, the richest 20 percent of households in low- and middle-income countries capture six times more in total fuel product subsidies than the poorest 20 percent of households, with gasoline being the most regressive (that is, subsidy benefits increase as income increases) and kerosene being progressive. IEA data show that subsidies to natural gas and electricity have also been found to be badly targeted, with the poorest 20 percent of households receiving 10 percent of natural gas subsidies and 9 percent of electricity subsidies (IEA 2011).

policy makers design targeted mitigation measures to protect the poor and vulnerable from the impacts of the reform. In addition to enabling a comprehensive understanding of the way in which the current arrangements benefit different households, and how households stand to be affected by different reform options, better understanding distributional impacts through distributional analysis assessments can help decision-makers evaluate and address political economy constraints that may affect implementation of the reform (Inchauste and Victor 2017; Inchauste, Victor, and Schiffer 2018).

Various approaches can be used to assess poverty and the distributional impacts of energy subsidies and their reform. These include quantitative approaches assessing the direct and indirect effects of the subsidies in contexts in which the reform leads to higher prices paid by energy consumers and qualitative approaches that enhance the findings of the quantitative analysis by focusing on the vulnerability of specific groups. The quantitative approaches rely on household budget and expenditure surveys and compare the welfare of various groups of households before and after the reform using simulations and modeling tools. They can also be part of a broader assessment of fiscal and social transfers. The qualitative approaches rely on feedback from households on energy services and related transfers or subsidies, and use surveys, questionnaires, focus group discussions, and in-depth interviews to explore attitudes and mitigation issues.

Each analytical approach to assessing the distributional impacts of energy subsidy reforms has different strengths, weaknesses, and resource requirements, and carefully considering the approach that fits the objectives of the specific analytical exercise is important. This report reviews the main analytical approaches for poverty and distributional analyses and explores how different methods have been used to support real-world energy subsidy reform efforts, drawing on the body of technical assistance funded by the Energy Sector Management Assistance Program's (ESMAP's) Energy Subsidy Reform Facility since 2014. A detailed review of the main methodologies and analytical approaches, followed by an examination of their application to actual reform efforts—from those focusing on electricity tariffs in Guinea and petroleum products in Indonesia to gas and heating in Ukraine and Uzbekistan—illustrates how various approaches can help identify, assess, and develop ways to address the potential impacts of reforms on poverty, affordability, and inequality.

Country and sector context, reform objectives, and systemic factors play critical roles in influencing the feasibility and usefulness of approaches to distributional analysis. As a first critical step, practitioners considering distributional analysis in relation to energy subsidy reforms need to invest time to understand the context within which the reform is being developed, assess its objectives, evaluate availability of data and resources, and accordingly choose the analytical tool that best fits their needs. Once that choice is made, the analytical approach can be customized to the context. Developing an understanding of the potential impacts of reforms may require combining diverse sources of information and methods. The assumptions of the analysis should be guided by the type of energy source and market conditions.

A review of recent real-world examples illustrates the design, approach, and data and methodological challenges that will be relevant when seeking to understand the distributional impacts and policy implications of reforms. The country cases reviewed for this report, each of which involves a different analytical approach, shed light on the main elements that guide the choice of analytical approach, model design, and implementation arrangements for the analysis.

- *Distributional analysis of energy tariff reform using limited modeling in a data-constrained environment.* The Guinea case study reviews a situation in which ad hoc modeling was needed to simulate the alternative reform scenarios to be considered in a context with serious data availability and quality challenges. In this case, electricity subsidies had been publicly funded for years, providing benefits to a limited share of the population, mostly urban and better-off, that was already connected to the grid. Affordability issues for several price increase scenarios were at the center of the analysis given the national focus on expansion of electricity access to lower-income households in a country with prevalent poverty.

- *Distributional analysis of energy subsidies as part of broader fiscal analysis using the Commitment to Equity (CEQ) framework.* The Indonesia case study demonstrates how the analysis of electricity and fuel subsidies may be part of a broader approach to assessing the distributional impact of fiscal policies using the fiscal incidence analysis under the CEQ framework (Lustig 2018). This approach was especially useful in highlighting the fiscal magnitude and distributional impact of energy subsidies relative to other, more effective, social programs. Under this framework, various programs can be compared with each other in multiple dimensions—efficiency, marginal contribution, progressivity, and so on. Given the substantial indirect effects of fuel subsidies on the prices of all other goods and services, this case also demonstrates the usefulness of a limited general equilibrium approach to account for indirect effects of fuel subsidies in addition to the direct effects coming from households' fuel consumption. A critical point to recognize is that some energy subsidies cannot directly be converted into fiscal revenue or savings to the government once eliminated because some subsidies don't involve explicit fiscal transfers.[3] In such cases, their elimination does not immediately lead to fiscal resources being freed up and can be redeployed for other purposes (Kojima 2017).
- *Standard distributional analysis of targeted and untargeted energy subsidies with relatively high complexity and data requirements.* The Ukraine case study covers the energy subsidy reform initiated in 2014 involving unprecedented increases in gas and heating tariffs, along with targeted subsidies and social assistance delivered through energy bills, which quickly became the key component of the social safety net program in Ukraine. The analytical activity supporting this reform effort used the standard distributional analysis approach. The complexity of the energy system and the intricacies of the reform program required detailed modeling, posing several data challenges despite access to extensive quantitative data. The challenges imposed by the seasonality of residential heating are shared by most countries of the Europe and Central Asia region.
- *Qualitative methods to complement quantitative work.* The Uzbekistan case study is a case in which energy subsidies were also high and qualitative methods and data were used to guide the reform because service quality issues and energy inefficiencies were prevalent. This case highlights the use of complementary approaches to assess the potential impact of reforms, including methods that allow policy makers to gauge the population's readiness for the reform.

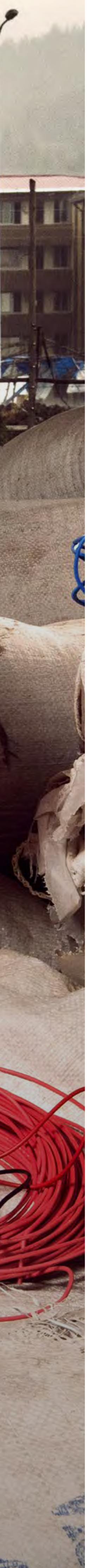
Even when well-developed methodologies are available, the quality and completeness of a distributional analysis for energy subsidy reform are highly dependent on data availability and underlying assumptions. Results are sensitive to the design, assumptions, and limitations of the simulation models. The modeling effort must be fully transparent to allow practitioners and decision-makers to be aware of its limitations so they can avoid overinterpreting results when assumptions or data are not reliable or may have changed. When interpreting the results of qualitative surveys, recognizing the

[3] This is true, for example, in the case of an inefficient state-owned enterprise, or oil-producing country that sells the commodity domestically at a lower price than the export parity price, with significant opportunity cost to the economy.

context, design, and limitations of the approach is critical, given that the objective of the study is to understand the perspectives of specific groups. Qualitative analysis can contribute to the government's toolbox of options for understanding, assessing, and evaluating potential distributional impacts and household perspectives, ideally in combination with quantitative methods to address the potential distributional impacts that may result from the reforms.

Well-designed and context-appropriate distributional analysis can strengthen reform efforts by helping identify mitigation options that can be built into the reform design. The choice of analytical tools should be guided by country context, reform objectives, and the strengths and weaknesses of different modeling approaches, as well as by the availability of data and resources. Having the right skill set on board and fostering collaboration among experts with diverse technical expertise is critical to a sound distributional assessment of a reform initiative under consideration. Going forward, distributional analyses can be further strengthened by incorporating indicators to assess the distributive impact of the reform on households, especially where energy affordability and poverty are significant issues, in addition to the resulting distributional *incidence*.

ONE
Introduction and Overview



The pervasiveness and magnitude of energy subsidies have prompted energy subsidy reforms aimed at reducing the substantial amount of government spending while gaining an understanding of and managing the distributional impact of reforms. Because most energy subsidies tend to accrue to the wealthiest households, which consume more energy on average, energy price subsidies are often an inefficient way of protecting the poor and reducing poverty or inequality. In contexts without universal household access to energy services, whether gas, district heating, or electricity, the benefits of the price subsidies do not reach those without access to those services, which can be as high as 70 percent of the population in some countries in Sub-Saharan Africa.

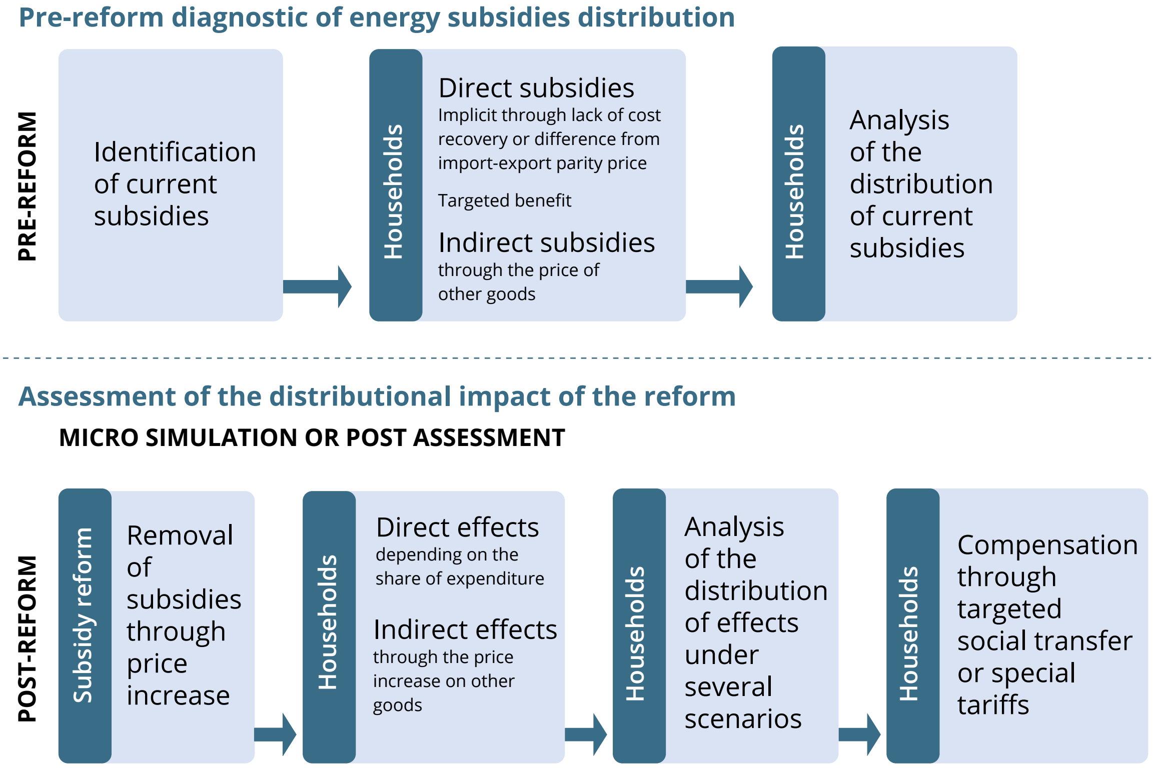
Energy subsidies also take up significant government resources and leave little fiscal space for other critical priorities. The magnitude of energy price subsidies varies across countries and regions and by energy source and end use, as well as over time, but in many cases governments direct substantial spending to cover their cost, sometimes more than what they spend on social assistance, health, and education. In the Europe and Central Asia region, where substantial amounts of energy are used for heating, energy subsidies for heating fuels, gas, and district heating tend to be significant and have been the focus of reforms in many countries. Uzbekistan stood out with energy subsidies, mainly for natural gas, that amounted to 25 percent of the country's GDP in 2012, and in Ukraine, energy subsidies, mostly for residential gas use and district heating, reached 6.6 percent of GDP before the reform.[1] To put this in perspective, in the Middle East and North Africa region, energy subsidies focus mainly on petroleum products, and can reach 2 or 3 percent of GDP or even higher as in Algeria, the Arab Republic of Egypt, the Islamic Republic of Iran, or Libya according to International Energy Agency (IEA) calculations.[2] In Guinea, the government subsidy for electricity topped 1.7 percent of GDP in 2019 (IMF 2020), which is in the same range as government expenditures for education, even though electricity coverage is limited and despite the fact that the electricity subsidy is an actual expenditure outflow for the government in the form of a transfer to the electricity utility. In Latin America, energy subsidies cover mostly petroleum products and electricity.[3] In Asia, subsidies are also provided for fuels and electricity, and vary significantly based on country context, with estimates ranging from 0.6 percent of GDP in China, to 2.6 percent in India, 2.7 percent in Indonesia, and 5.6 percent in Bangladesh (IEA Energy Subsidy Database 2022).

Most of the key questions concerning the distributional analysis of energy reforms can be tackled through a framework that starts with assessing the pre-reform distribution of existing energy subsidies, followed by the simulation of price increase options under consideration as part of the reform. This analysis can be supplemented by simulation of mitigation mechanisms. Figure 1.1 presents the standard framework for the

[1] In both instances, subsidy reforms led to a significant reduction of energy subsidies, as detailed in the case studies; however, subsidies rebounded with the 2021 energy crisis, nearing pre-reform levels and tripling from 2020 to 2021 in both countries.
[2] The IEA, using a price-gap approach to quantify subsidies using export parity prices as reference prices, estimates high levels of petroleum product subsidies in exporting countries. Expressed in terms of opportunity cost, these subsidies estimated for exporting countries do not imply actual fiscal costs incurred by the government.
[3] Between 2011 and 2014, Central American countries spent a combined US$1.3 billion per year on electricity subsidies, or 1 percent of the region's aggregate GDP, and less than 40 percent of the subsidies go to the poorest 40 percent of the population (Hernandez Ore et al. 2017).

FIGURE 1.1

Conceptual Framework for Distributional Analysis of Energy Subsidy Reforms



Source: Authors' illustration based on original work.

distributional analysis of energy subsidy reforms, with a pre-reform diagnostic followed by an assessment of the distributional impact of the reform.

A critical element in the pre-reform analysis is the assessment of the magnitude and distribution of existing energy subsidies, which differ between households according to the energy source, the way energy is consumed, and the availability of alternatives. For example, in Ukraine and other countries in the Europe and Central Asia region, where most residential energy consumption is for heating during the winter, gas consumption has been increasing with wealth as well as access to district heating; consequently, subsidies benefit wealthier households more, whether through gas used for heating or through district heating. In Sub-Saharan Africa, and in particular in Guinea, which is one of the case studies in this report, access to grid electricity has been more intensive around the capital and other urban centers; therefore, the benefits of subsidies accrue to the better-off portions of the population. With regard to refined petroleum products, the type of fuel consumed varies with household income in most regions of the world. For example, gasoline is commonly consumed in greater amounts by wealthier households owning cars, as illustrated by the Indonesia case study in this report. For network-supplied energy, households may face different average prices depending on the consumption volume (in the case of block tariffs) or consumer category (metered versus unmetered consumption or specific social categories). In other contexts, shortages or rationing may alter the prices faced by poorer households, which may need to rely on informal alternatives. One fundamental difference between energy delivered through networks (such as electricity, natural gas, or district heating) and liquid fuels (such as gasoline, diesel, and liquefied petroleum gas) stems from the ability to transport and store liquid fuels, enabling black markets to develop and smuggling to occur. In such cases, the price paid by consumers may be different than the official price and would alter the results of the assessment.[4]

At the core of the distributional analysis of the reform is the assessment of how the removal of subsidies translates into various options for price increase pathways and what they mean for households across the distribution. The impacts of energy price increases are rarely uniform across households, either because of pre-reform price heterogeneity or because of the design of the reform itself. Because energy price increases can have large impacts across sectors and the broader economy, an important consideration is the extent to which those indirect effects should be considered in the distributional analysis.[5] In many cases, whether to consider indirect effects will depend on the magnitude of the price increase and the known channels of impact, as with the reforms in Indonesia discussed later in this report.

A subsequent priority is to identify options for mitigating impacts on the welfare of vulnerable groups. This kind of analysis typically focuses on how to compensate the poorest households or citizens for any welfare loss either directly (through better-targeted energy subsidies) or by redirecting government spending for previously untargeted energy subsidies into pro-poor social programs. The Ukraine Housing and Utility Subsidy (HUS) program is an example of how an existing social protection program was leveraged to support households during the reform and eventually made the transition to being a fully targeted program. According to World Bank team estimates, without the HUS program, the average energy expenditures of the bottom 30th percentile of households could have equaled as much as 20 percent of total household expenditures after the 2015 energy tariff increases, whereas with the mitigation measures delivered through the HUS, this share could be contained to 10 percent, on average.

In addition to quantitative assessments to improve the reform's design, other constraints to reform may be present that might not be visible in a standard quantitative analysis. In that context, it is important to understand consumer attitudes, perceptions, and readiness for energy reforms, which may point to issues beyond the potential distributional impacts, such as coping mechanisms in the face of high energy prices. These attitudes are best assessed through qualitative studies, as detailed in the Energy Subsidy Reform Assessment Framework (ESRAF) Guidance Note 4 (Canpolat and

[4] This data issue may also occur with network utilities where informal connections are widespread and the official utility tariff does not apply to all users.
[5] Direct and indirect impacts of energy subsidy reform are explored in ESRAF Good Practice Note 3, "Analyzing the Incidence of Consumer Price Subsidies and the Impact of Reform on Households—Quantitative Analysis" (Olivier and Ruggeri Laderchi 2018).

Georgieva 2018). For instance, in Uzbekistan, the qualitative assessment revealed important concerns about the quality of energy services among the most vulnerable households and the reliance on alternative sources of energy, which are often costly. Such qualitative issues can be largely missed by quantitative surveys; therefore, qualitative assessments involving approaches such as focus group discussions, key informant interviews, or mobile surveys can provide valuable insights into the expected effects of an energy subsidy reform initiative.

This report aims to contribute to the global knowledge base on energy subsidy reform by exploring how poverty and distributional analyses have been used to support energy subsidy reform efforts. To this end, this report reviews select country-specific activities supported by the Energy Sector Management Assistance Program (ESMAP) and its Energy Subsidy Reform Facility (ESRF).[6] The report begins by providing an overview of key distributional issues related to energy subsidy reforms and emerging lessons from a global stocktaking of practices, as well as country-specific insights from case studies. The report then discusses different approaches to the use of distributional analysis for gaining an understanding of the impacts of energy subsidy reforms in select country contexts, specifically in Guinea, Indonesia, Ukraine, and Uzbekistan.

The cases reviewed in this report provide a sense of the breadth of possible analytical approaches and cover a wide range of energy subsidy reforms and issues in different contexts. The report explores the analytical approaches in countries with different sector challenges and for reforms involving several types of energy, from electricity in Guinea and petroleum fuels in Indonesia to gas and heating in Ukraine and Uzbekistan. The report discusses the impacts of reforms on poverty, affordability, and inequality and the role of systemic factors such as access. The review also highlights the data and methodological challenges faced by teams when undertaking distributional analyses and the policy implications of these reforms.

The report is aimed at practitioners and policymakers. While certain technical material in the report, in particular Chapter 2, is intended mainly for poverty economists and specialists in this field, the practical application of these methodologies and approaches in the context of real-world energy subsidy reforms is relevant for both practitioners and policy makers. Thus, the conclusions and findings have policy significance, and as such are intended to be useful to both poverty economists and less specialized practitioners.

This report is organized into four chapters. After a general overview and introduction of key concepts in chapter 1, the report introduces main approaches and methodologies for distributional analysis in the context of energy subsidy reform in chapter 2. With its technical focus, this chapter is intended mainly for poverty economists and specialists in this field. Chapter 3 focuses on practical implementation of these methodologies and approaches by applying them to analyses of real-world energy subsidy reforms carried out in Guinea, Indonesia, Ukraine, and Uzbekistan. Each country presents unique sector

[6] The report complements the Good Practice Notes issued by ESRAF, particularly Note 3, "Analyzing the Incidence of Consumer Price Subsidies and the Impact of Reform on Households—Quantitative Analysis" (Olivier and Ruggeri Laderchi 2018).

contexts, reform challenges, and distributional analysis approaches. This chapter is intended to be relevant for practitioners and policy makers seeking to understand how distributional analysis was used to inform and refine the design of real-world energy subsidy reforms. As such, the chapter offers practical insights for those embarking on reform efforts, or supporting governments in doing so, by providing an understanding of how distributional analyses can be designed, how different methodologies can be adapted to specific country contexts and data availability, and how implementation challenges can be addressed. Chapter 4 draws insights and conclusions based on the review of methodologies, approaches, and case studies.

TWO

Approaches for Assessing Distributional Impacts of Energy Subsidy Reforms

This chapter reviews the main methodological approaches used to assess the distributional and poverty impacts of energy subsidies and their reforms. In this review, the chapter draws from and expands on the approaches covered in ESRAF Good Practice Notes 3 (Olivier and Ruggeri Laderchi 2018) and 4 (Canpolat and Georgieva 2018) and in recent analytical work carried out by World Bank technical teams in support of their government counterparts, with funding from the ESMAP ESRF. It also draws from a set of studies applying the Commitment to Equity (CEQ) methodology, assessing subsidies in a broader fiscal analysis context. While reviewing the different methodologies, the chapter discusses key design considerations and the main challenges for quantitative approaches to distributional impact assessments.

2.1 General versus Partial Equilibrium

The simplest quantitative assessment relies on estimating the partial equilibrium effects of an energy price increase, at least as an intermediate step, and does not take into account the effect of the price increase on other goods consumed by households. Such direct impacts can be limited to the purchasing power loss for households following the energy price increase or broadened to include the welfare loss incurred. The purchasing power loss is the simplest measure, measuring the impact on households' real incomes and expenditures, and is proportional to the share spent on the item in household expenditures. For example, if a household devotes 2 percent of its total expenditure to a given energy source, the price of which is expected to double (increase by 100 percent), and it makes no adjustment to the amount it consumes, its purchasing power loss will be 2 percent. This can be thought of as the real income or expenditure of the household contracting by 2 percent.[7] This approach lends itself to estimating impacts (in partial equilibrium) that incorporate the purchasing power loss that households can experience into the welfare indicator of interest (for example, household per capita income or consumption). However, the assumption that households do not change their behavior in the face of an increase in prices is simplistic or focused on the short term. If households reduce their consumption or substitute an alternative good, the welfare loss would be smaller than these estimates imply.

A more comprehensive approach consists of measuring the impact on households as measured by their welfare loss. Following Hicks (1942), the welfare impact on households of a price change for a purchased good can be understood as the additional expenditure required following a price increase to reach the same level of utility as with the initial price. This measure, based on the utility from the consumption and not the consumption

[7] This loss of purchasing power, assuming constant consumption, is expressed as a share of total income and corresponds in nominal terms to the Laspeyres variation—the amount of money required for the household to maintain its initial level of consumption.

itself, is called the compensating variation.[8] Such a measure would require prior knowledge of the preferences of consumers. Various methodologies have been presented in the theoretical and empirical literature to approximate this welfare measure with limited assumptions. Among the simplest approximation of the welfare measure is the Laspeyres variation, that is, the change in income required to purchase the original quantities of the good after the price has changed (equivalent to the loss of purchasing power in the first approach presented earlier). This measure would be an upper bound[9] of the actual welfare change in the absence of energy shortages before the price increase.[10] Another widely used measure to approximate the welfare loss is the loss of consumer surplus, which requires information on the demand function, but not on preferences. For nonnegligible price elasticities,[11] where consumption is adjusted following a price variation, this measure underestimates the true welfare effect of a price increase because it does not assume constant utility and is thus smaller than the compensating variation. The Laspeyres variation and the consumer surplus loss can therefore be used as the lower and upper bounds of the true value of the welfare change for an energy price increase when the welfare reference period is the period prior to the price increase. The lower the price elasticity, the closer these measures will be. When price elasticity is low and close to zero, the Laspeyres variation is a good measure of the compensating variation (see Cory and others [1981], as well as Araar and Verme [2016] for a comprehensive review of these measures).

To account for the effect of the energy price increase on other economic sectors based on their energy intensity, general equilibrium approaches are required. Increases in the prices of the goods produced in each sector may feed through to other sectors, so that the process is iterative and sensitive to the possibility of switching away from fuels and away from goods and services that are intensive in energy, which will have relatively high price increases, toward those with relatively low increases. As consumers switch to consuming goods that are less energy intensive, the structure of production would shift toward less-energy-intensive goods. This would, in turn, have impacts on employment and wages, potentially leaving workers in energy-intensive industries behind. The longer-term effects that would account for these adjustments would require the use of a general equilibrium model, such as a computable general equilibrium (CGE) model, which allows the behavior of firms and consumers to be fully flexible, as detailed in Burns,

[8] This report does not retain the notions of equivalent variation or Paasche variation, given that these variations use as a reference the welfare or consumption level after the price increase, and thus do not take into account the loss of welfare incurred by the reduction in consumption. These two measures are commonly used in the fiscal literature where the reference period is the one following the change in price (the post-tax period).

[9] Because the utility level for constant consumption with a higher price would increase, such an estimation would then overestimate the welfare impact compared with a utility level that remains constant. The Laspeyres variation can thus be viewed as an upper bound of the true welfare change.

[10] If energy rationing were preventing households from purchasing more energy, should shortages be significantly reduced following the price increase, some or many households may purchase greater quantities despite the price increase.

[11] The qualitative literature on Eastern Europe reports that poorer households have lower price elasticity because they are closer to a subsistence level; these findings are confirmed by Zhang (2011) in Turkey, where the electricity own price elasticity is estimated at −0.08 for the poorest quintile and −0.5 for the wealthiest in 2008. Assumptions of quasi-inelastic energy consumption for the estimation of the impact on poverty is thus reasonable for electricity in richer countries, though it seems likely that other energy sources (such as cooking fuels) in other contexts (such as Sub-Saharan Africa or South Asia) would require different assumptions. In the upper part of the distribution, as well as for most petroleum products, price elasticities are likely to be significant. In cases of acute shortages, the price elasticity may even become positive. A review by Dahl (2012) reports estimates of between −0.11 and −0.33 for gasoline, and of between −0.13 and −0.38 for diesel. The price elasticity for gasoline appears to be higher in richer countries. Vagliasindi (2013) reports that long-run elasticities are significantly higher than short-run elasticities.

Djiofack, and Prihardini (2018). CGE models are also required to assess further impacts, such as the potential reduction of competitiveness of energy-intensive industries following the removal of energy subsidies, as shown by Burniaux and Chateau (2011). CGE models require additional assumptions, including the idea that the economy is in equilibrium in the baseline period. The model then assesses the impact of the proposed energy subsidy reform in a new equilibrium, but the models do not systematically describe the transition process to the new steady state. Although CGE models are outside the scope of this report, they are an increasingly used and useful component of the analytical toolkit available to policy makers and practitioners considering energy subsidy reform initiatives. In this context, it is important to point out that a key determinant of acceptability and feasibility of a proposed energy subsidy reform initiative is precisely what happens to vulnerable groups in the short term and the mitigation measures that may be incorporated into the design of the reform to address some of the most critical impacts. Nevertheless, it is possible to enable the inclusion of some behavioral responses as well as indirect effects in limited equilibrium approaches, as described later in this report.

2.2 Direct versus Indirect Effects

For energy primarily used for heating (usually gas or district heating) and subsidies concentrated among residential consumers, typically only the direct effects are estimated because the likelihood of having impacts on other markets is small. In these cases, the magnitude of the welfare effect will depend on the magnitude of the price gap, the share of total expenditure devoted to energy, and price elasticities of demand. For petroleum products, as well as for electricity in some instances—which are important inputs to production—partial or full removal of subsidies can have impacts on production technologies and the prices of other goods. In these cases, both direct and indirect effects must be evaluated because the magnitude of indirect effects can be substantial. For instance, in their review of 32 countries, Coady, Flamini, and Sears (2015) estimate that indirect effects account for about 55 percent of the potential impact of the increase in fuel prices, with significant differences by region depending on the energy intensity of household consumption.[12] Jellema and Inchauste (2018) find that, among 20 countries covering regions across the globe, indirect effects of higher fuel prices on welfare accounted for nearly 60 percent of the total impact.

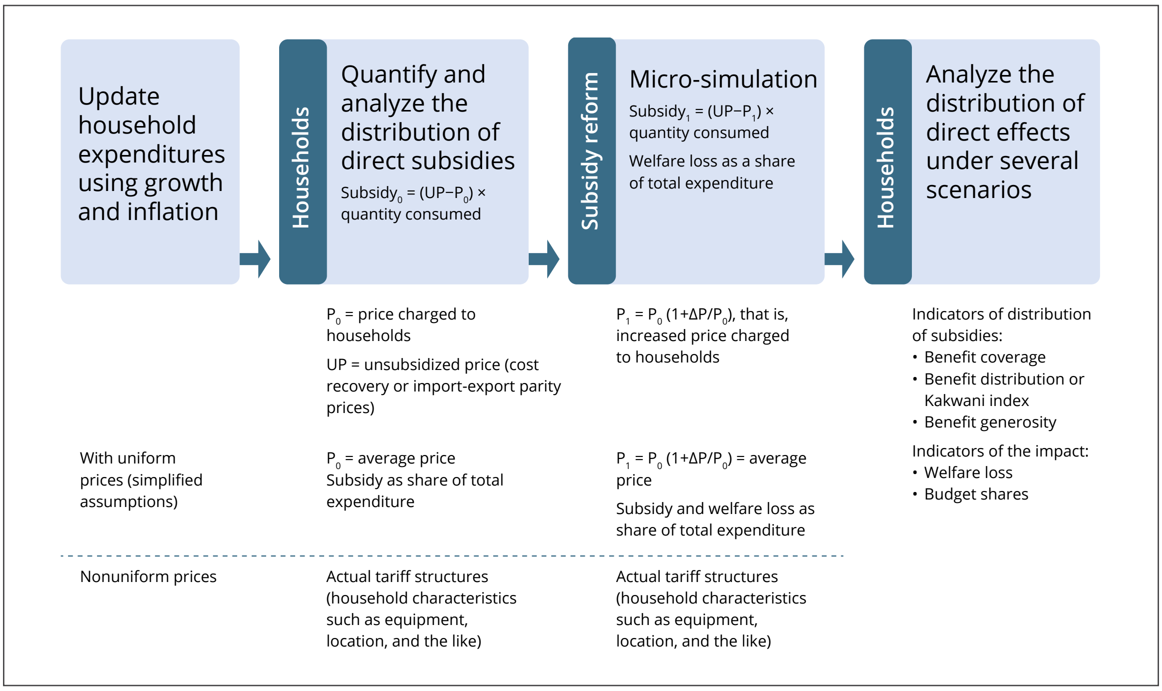
Estimation of the direct effects of gas or electricity price increases permits the analysis of complex tariff structures with nonuniform prices (varying with consumption) and prices that are differentiated depending on consumer category or

[12] Note that the findings on the magnitude of indirect effects are likely to be significantly overstated because of the use of input-output analysis, which is based on fixed coefficients (that is, there is no scope for substitution), as recognized by Coady, Flamini, and Sears (2015). Estimates should therefore be considered to be short-term effects or upper bounds of the long-term effects.

energy-consuming equipment in the household. The quantification and analysis of the direct effect of subsidies requires that the gap between the unsubsidized price (usually the cost recovery price for electricity or the import-export parity price for gas or refined petroleum products) and the price actually charged to households be identified.[13] When prices are uniform or almost uniform across households, the analysis can simply use the difference between the unsubsidized price and the average price and calculate the current and the revised subsidies as shares of total expenditure. When prices are not uniform across households and these differences are significant across the distribution, then the subsidy at the household level using actual tariff structures needs to be calculated, based on household characteristics, equipment, location, and any other relevant variables provided in household budget surveys. Figure 2.1 shows a typical sequence of analysis for the evaluation of the direct effects in practice, with a prior estimation of the pre-reform subsidy (based on household expenditures updated to the period of reference) and a simulation of the post-reform subsidy.

FIGURE 2.1

Evaluation of the Direct Effects of Price Increases in Practice



Source: Authors' illustration.

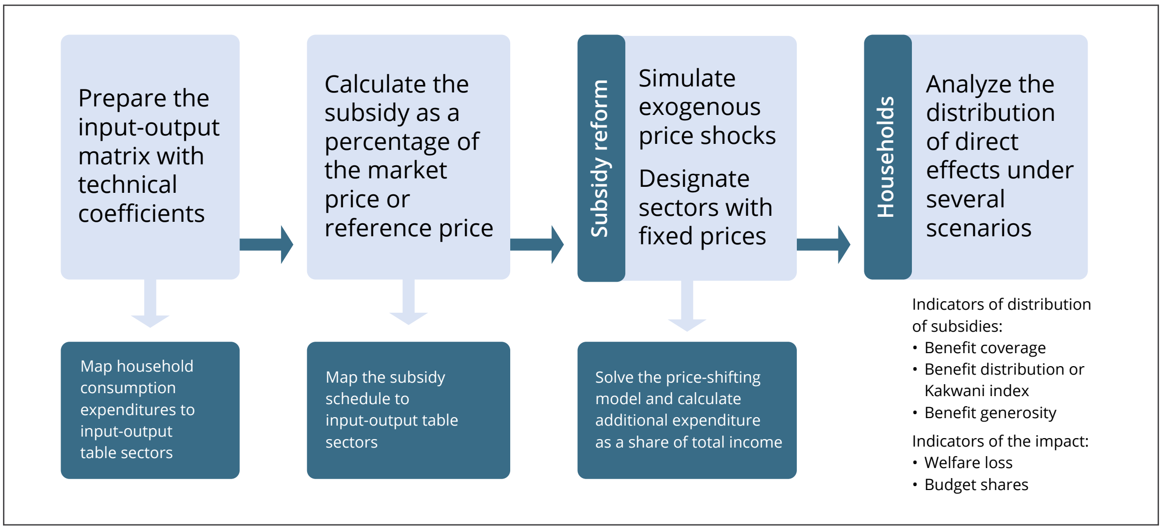
[13] For a systematic review of approaches to quantification of subsidies, see ESRAF Guidance Note 1 (Kojima 2017).

Estimating the indirect effects of price increases may require the use of general equilibrium approaches that include estimates of the effects of the energy price increase on other goods consumed by households in addition to the direct effects from their energy consumption. Depending on the energy carrier under consideration and the availability of an input-output matrix or a social accounting matrix, a simpler approach can be used to incorporate only some indirect effects that, a priori, are considered most relevant. This approach, which can be referred to as using "limited general equilibrium," would involve identifying and quantifying effects based on some assumptions about which channels are likely to matter the most in a given context. As shown in figure 2.2, the first step is to prepare an input-output matrix with the technical coefficients between sectors, and map all the items that make up household consumption expenditure in the household survey to the relevant sectors in the input-output matrix. The main issue here is often the requirement for data given that the input-output table should be sufficiently disaggregated and up to date.

Thereafter, the subsidy as a percentage of the market or reference price can be calculated for each energy item included in the reform under consideration. This subsidy schedule would then be mapped to the input-output table sectors. The simulation

FIGURE 2.2

Evaluating the Indirect Effects of Energy Price Increases in Practice



Source: Authors' illustration based on Jellema and Inchauste (2018).

of the required price increase would then be applied to each relevant sector. Because nearly all goods and services use energy as an input, this process will affect the cost structure of nearly all goods except goods for which prices are regulated. The change in energy prices is applied using the technical coefficients from input-output tables, which remain fixed over the analysis (Jellema and Inchauste 2018). The difference in prices of other goods and services resulting from this channel is interpreted as indirect effects. These indirect effects can be evaluated separately or in addition to the direct effects, using the same welfare indicators as for the direct effects.

The indicators for both direct and indirect impacts are of two kinds: indicators for the distributional performance of the subsidy on the one hand (share of population receiving benefits; relative contribution to post-fiscal income; and various measures of progressivity including the Kakwani index[14]) and indicators of the impact on households on the other hand (welfare loss and budget shares). The welfare loss measure can be simply approximated by the increase in expenditure if consumption remains constant, or by the consumer surplus if behavioral responses are included, so that the reduction of welfare through the reduction of consumption is accounted for.

Prepackaged simulation models such as the World Bank tool SUBSIM (SUBsidy SIMulation Stata Package) are available to facilitate rapid distributional analyses of energy subsidies and simulations of subsidy and price reforms (Araar and Verme 2012). The model, initially developed for the Middle East and North Africa region with a focus on oil prices, can also be applied to energy, food, or water subsidies and accommodates linear and nonlinear pricing for the direct effects, with some simplifying assumptions. For estimation of the indirect effects, the SUBSIM software automatically creates a technical coefficient matrix from the input-output matrix. The price-shifting model presented above is simulated under a "permanent price shock" option with a long-term price adjustment. The model estimates the impact of subsidy reforms on household welfare, poverty and inequality, and the government budget with or without compensatory cash transfers. It either estimates an upper bound of the household welfare effect of the price increase, assuming that the loss in welfare is approximated by the total expenditures required to maintain the same level of consumption as before the price increase (thus the Laspeyres variation) or a lower bound (the equivalent variation) using as a reference the welfare level after the price increase, with an assumption about preferences based on a Cobb-Douglas utility function as well as price elasticity. The IMF has also developed a set of publicly accessible Stata dofiles that estimate the direct and indirect effects of indirect taxes or subsidies using the price-shifting model described previously. Both tools provide a rapid analysis that includes the indirect effect of price increases on household welfare. In the case of a networked utility with complex tariff structures, such as when different tariffs apply to specific customer categories or specific equipment holders (as is quite common in gas tariffs in the Europe and Central Asia region), ready-made products that lend

[14] The Kakwani index is a measure of the progressivity of a social intervention based on the difference between Gini indicators (Son and Kakwani 2006).

themselves to rapid analysis might disregard some of the specificities of the tariffs that apply to the most vulnerable households and thus provide an inaccurate approximation of the impacts that would matter the most to the analyst.

2.3 Subsidy Analysis as Part of a Broader Fiscal Incidence Assessment

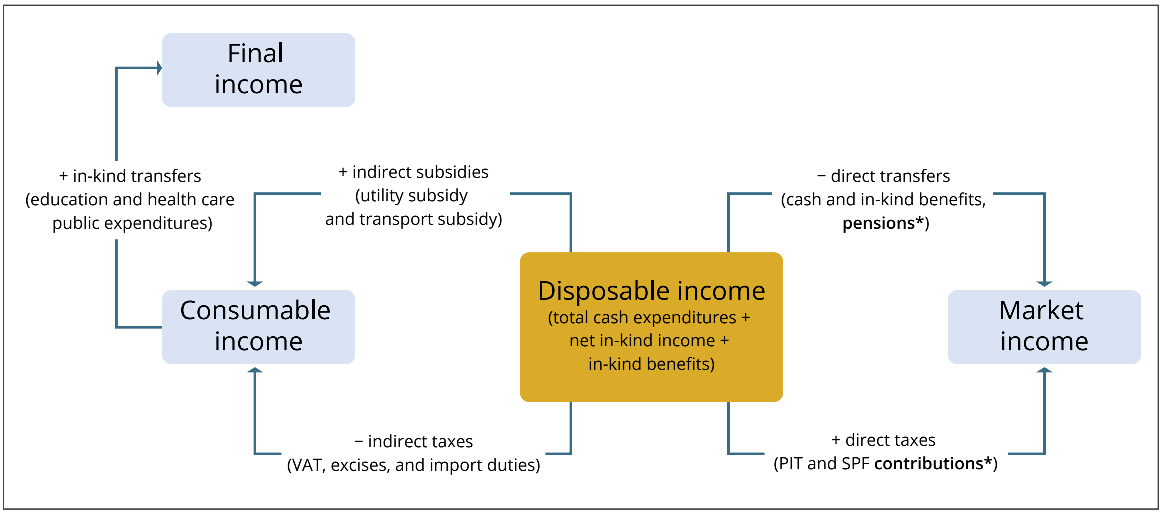
The CEQ methodology[15] provides a way to assess the direct and indirect effects of subsidies in a broader context of fiscal incidence analysis of tax and social interventions. Energy subsidies in this approach are differentiated from social in-kind transfers (such as education and health expenditures) and are considered to be government-funded "indirect subsidies" to be added to the disposable income of households and form part of "consumable income." The assessment of the welfare impacts of each fiscal intervention is based on indicators of coverage; relative and absolute incidence;[16] the Kakwani index; and the intervention's marginal contribution to poverty and inequality. The case study on Indonesia details how this methodology was used to assess the direct and indirect distributional impacts of fiscal and social policies, including electricity and petroleum product subsidies, using an input-output table for the economy. This broad-based assessment provided the analytical basis for a series of government actions, which included the elimination of most subsidies for fuel and electricity (a reduction from 3.7 percent of GDP in 2012 to 1.7 percent in 2019, according to IEA data), in favor of expanding the social transfer program to 10 million beneficiaries in 2017 (Tiwari et al. 2020).

The CEQ methodology uses a household survey and allocates taxes and benefits, both cash and in-kind, to individuals to allow comparison of incomes before and after taxes and transfers (Lustig and Higgins 2018). The methodology relies on four main income concepts, from market income to final income, as illustrated in figure 2.3: the point of departure is *market income*, that is, household income before any tax or benefit, comprising income from all forms of employment, capital income (rent and dividends), and private transfers. The next income concept comprises market income plus pensions (which include contributory pensions and exclude the respective pension contributions), then subtracts direct taxes and social insurance contributions other than those for pensions and adds direct cash transfers (and other social benefits except pensions) to generate disposable income. Disposable income is typically the key income concept in standard analyses of poverty and inequality, and as such, fiscal incidence analysis typically stops here. CEQ analysis computes two further income concepts by subtracting indirect taxes (VAT and

[15] See *Commitment to Equity Handbook* (Lustig 2018).
[16] Relative incidence refers to the size of the subsidy relative to household income, a measure similar to benefit generosity. Absolute incidence refers to the size of the subsidy that is directed to each decile, also called benefits incidence or targeting accuracy.

FIGURE 2.3

Construction of Income Concepts



Source: Bornukova, Leshchenko, and Matytsin 2019.
Note: PIT = personal income tax; SPF = social pension fund; VAT = value added tax.
* Pensions and SPF contributions are included in direct transfers and taxes, respectively, only within the approach using pensions as government transfers.

excises) and adding energy and fuel subsidies[17] to generate consumable income, which reflects the actual amount of market goods and services consumed by households. Eventually, final income is defined as the income aggregate that includes the cash equivalent of in-kind benefits, that is, the cost of public health and education services consumed by households (Lustig 2018).

Because it is possible to compute statistics such as the poverty rate or inequality indexes for each separate income concept, comparisons across different income concepts allow an assessment to be made of the marginal contributions of individual taxes and expenditure programs to poverty and inequality alleviation. In addition, each fiscal intervention is allocated to households in the survey sample, which provides insight into the incidence of various taxes and programs across different population groups; in other words, a profile of contributors and beneficiaries of different programs can be constructed (Jellema and Inchauste 2018), including breaking down each type of energy subsidy.

[17] Note that in the CEQ assessments, energy subsidies are usually identified as "indirect subsidies," which include energy subsidies but also other government subsidies such as those for agriculture, but that term is avoided here. They are specifically called "energy subsidies" instead to be more consistent with other sections of the report and avoid confusion with direct and indirect effects.

2.4 Data and Inputs Needed for the Analysis

There are two main kinds of data required for energy subsidy reform analysis: the household expenditures typically reported in household budget surveys (expenditure on energy but also on other goods for indirect effects), and the price gap, based on the actual price applied to households and the reference price for the relevant energy source.[18] Information on the price gap requires the existing pricing or tariff structure, as well as information on what a cost-recovery or fair market price would be. If the analysis assumes that the reform eliminates the price gap in one go, the impact of the price increase can be assessed using the available information. In most cases, the price reform is actually a gradual process with successive price increases, up to full cost recovery. If the reform initiative being assessed follows the gradual approach, then data on the anticipated schedule of price increases is required. The level of detail for both types of data requirements depends on the complexity of the context and the credibility of the simplifying assumptions. Moreover, where indirect effects of the energy price increase on other goods are expected to be significant, as for most petroleum products, additional data are required in the form of an input-output matrix describing the current structure of the economy.

At the household level, the level of detail needed depends on the heterogeneity of energy use and the price structure. When tariffs are not uniform, nominal expenditures on energy from budget surveys are required without regional or temporal adjustments because price or tariff structures applied to households to derive the quantities consumed are in nominal terms, as are the price increases in the reform scenario. In addition, data often need to be updated for the year of the analysis to account for nominal or real income growth (either uniformly or, better, adjusted by quintile to take into account differentiated economic growth), and further assumptions might be required to disaggregate data between fuels (refined fuels might be aggregated or some utility expenditures might be aggregated).

It is important to highlight that expenditure, not units of energy consumed, is reported by households in the budget survey. Energy expenditure does not necessarily strongly correlate with consumption for multiple reasons: households with unmetered consumption might be charged a fixed amount; the tariff structure might depend on the location, type of equipment, volume, or season; fuels might be sold on the black market; shortages and rationing might limit consumption; infrequent billing (and missing expenditure for the period) might affect the reporting of expenditures; and arrears or regularization fees might be included. An additional challenge for the analysis involving energy consumption is the price elasticity of consumption, given than average price elasticities known from the literature are typically relevant for small changes, and in any case, only for households able to adapt their consumption to price, which excludes unmetered ones and households facing shortages or rationing, who are often the poorest. Sensitivity of the

[18] The total price gap is required to assess the distribution of the existing subsidies before the reform.

analysis to elasticities (including differentiated elasticities with zero or lower price elasticity for lower incomes) might be conducted for a more comprehensive analysis.

In cases with direct energy benefits, such as the in-kind subsidies in Ukraine, for example, or cash transfers, benefits provided to households are also affected by the price increase, and thus the formula used for calculation of eligibility and benefits by the social protection program is required for the simulation. A significant challenge is that theoretical eligibility is not the same as actual take-up by households. Benefits simulated at the household level, using eligibility thresholds, will typically assume perfect targeting and full uptake, where all eligible households receive benefits. In Ukraine, for instance, a large share of households became eligible to receive energy benefits as they reached the eligibility threshold, and simulations were conducted for both the coverage at the time of the survey and for coverage extended to all eligible households (discussed further in the Ukraine case study).

In addition, a welfare indicator is also required for the assessment of the distribution of impact among households. For consistency with poverty assessments, this indicator is usually total expenditures or income adjusted for time and location, and further adjusted by household size or adult-equivalent. The CEQ methodology requires additional data from households for a broader fiscal analysis, given that it measures poverty and inequality before and after different fiscal interventions based on the four income concepts described in figure 2.3, starting from market income to final income.

Along with household-reported information, data on energy prices are required to quantify the subsidies. Because electricity tariffs or fuel prices might not always be uniform, but rather will vary by category of consumers, knowledge of the actual price increase applied to each category is critical to be able to assess the distributional impact of the reforms. Prices used to quantify subsidies can be provided either as a percentage of the unsubsidized price or the actual unsubsidized price (often the import or export parity prices) and actual prices charged to households. Where detailed tariff schedules are not available for the analysis, a key challenge is related to average prices, which do not provide adequate information on actual prices charged to different household categories. Because the focus of the analysis is on the distribution of effects between income groups, differences in prices paid by households are critical for the analysis, and hence applying average prices can be misleading. For example, in Guinea, because of affordability concerns, the 2018 reform involved larger price increases applied to higher consumption tariff blocks. Looking at only average price increases would have overestimated the effects on lower-income consumers. Inversely, the reduction of the size of the first consumption block in 2019 affected mostly users just above the new threshold, and effects on this category of households could be underestimated by using an average price increase. More generally, moves from block tariffs to uniform cost-reflective tariffs stand to have greater impacts on users previously benefiting from lower tariffs (often the most vulnerable). In such an analysis, the use of actual tariff-increase data by category would avoid underestimating the impacts on households in each category. Regarding indirect effects, utilities generally apply different tariffs to residential and nonresidential users.

THREE
Case Studies

This chapter reviews energy subsidy reform support activities in four specific country engagements which benefited from ESMAP funding. These case studies show how different analytical approaches to poverty and distributional analyses were applied in specific country contexts and highlight select findings from those activities.

3.1 Analysis of Direct and Indirect Effects: 2018–19 Electricity Tariff Reforms in Guinea

This case study is an example of the use of distributional analysis in a situation in which the benefits of pre-reform electricity subsidies accrued to a limited portion of the population, mostly urban and better-off, that was already connected to the grid. To simulate alternative reform scenarios, a specific model was developed, and analysis was carried out amid serious data availability and quality challenges.

The distributional analysis focused on tariff increase scenarios that would take place over a relatively long period in an evolving sector where access to electricity service continued to be expanded. The distributional analysis focused not only on the direct effects of an electricity price increase, but also on indirect effects because the scenarios were balancing tariff increases between residential and nonresidential users. Although tariffs were far from cost-recovery levels, the affordability of price increase scenarios was at the center of the analysis given the national focus on expansion of electricity access to lower-income households in a country with prevalent poverty.

3.1.1 Background and Context

By 2018, Electricité de Guinée (EDG), the state-owned electricity company, had been facing financial deficits for several years. Tariffs were inadequate to cover the costs of service, which were high as a result of heavy reliance on thermal generation, operational inefficiencies, and commercial losses, among other reasons. Electricity tariffs had been constant in nominal terms between 2008 and 2018 despite high inflation rates, and covered less than 50 percent of all of EDG's costs in 2018. Technical and commercial losses accounted for more than half of the hidden costs (Trimble et al. 2016). At that time, only 29 percent of the population had access to electricity, and most households connected to the grid were not poor. The majority of households with access to grid electricity were urban households, mainly in the capital, Conakry (71 percent of households connected), where electricity access stood at 84 percent of the city's households, versus 39 percent in secondary cities and 1 percent in rural areas. Electricity tariffs for residential customers were cross-subsidized by other customers, and ultimately, the sector was being subsidized by the government, which had been providing significant transfers to support EDG's day-to-day operations. The fiscal cost of the support to EDG increased from 0.8 percent of GDP in 2018 to 1.7 percent in 2019, placing a heavy burden on public finances and limiting the fiscal space available for other sectors, notably health and education (IMF 2020).

In view of the challenges, the government of Guinea initiated an effort to strengthen the sector's financial sustainability, starting with tariff increases to bring them closer to cost-recovery levels by 2025/26, as part of a comprehensive Recovery Plan for the Energy Sector (Government of Guinea 2020). In May 2018, electricity tariffs increased by 10 percent for all residential users, except for those consuming less than 60 kWh/month, and by 25 percent for nonresidential users.[19] The reform strategy aimed to progressively increase tariffs over the 2019–25 period, including a moderation of these increases for the "social" bracket (the consumption bracket benefiting from the lower tariff) to protect the poorest.[20]

3.1.2 Analytical Approach and Methodology

To prepare for the recovery plan, the government, with support from the World Bank and funding from ESMAP, carried out successive distributional analyses to assess the potential impacts of different electricity tariff scenarios. The final scenarios considered in these analyses, conducted in 2018 and 2019, are detailed in table 3.1.

TABLE 3.1

Guinea: Price Increase Scenarios for Residential and Nonresidential Customers, 2018–25

Scenarios[a]	Average cumulative nominal price increase (%) for the period, compared with 2018 tariffs[b]	
	Residential	Nonresidential[c]
Scenario 1	95 (32 for 0–40 kWh/month bracket)	82
Scenario 2	166 (50 for 0–40 kWh/month bracket)	60
Scenario 3	219 (63 for 0–40 kWh/month bracket)	45

Source: Authors' elaboration based on Government of Guinea (2020) and World Bank financial scenario documents for the Recovery Plan for the Energy Sector.
Note: kWh = kilowatt-hour.
a. Price increase scenarios according to the modulation between residential and nonresidential customers.
b. Note that expected inflation (average consumer price inflation) was about 8 percent per year, thus a cumulative 72 percent for the period 2018–25 (according to the October 2019 World Economic Outlook database), and it should be revised to a cumulative amount of 103 percent by 2025 according to the April 2022 World Economic Outlook database.
c. Electricity tariffs for Mines and Export are expected to provide new revenues for the utility.

[19] This case study uses the Guinean franc (GF) because the analysis focused on tariffs and their local affordability. For context, the official exchange rate was GF 9,011 per US$ in 2018 and GF 9,565.08 per US$ in 2020 (World Bank, World Development Indicators).
[20] A consumer with monthly consumption of 40 kWh was billed GF 211/kWh in 2018 (about US$0.022/kWh) and 357 GF/kWh in 2021 (about US$0.039/kWh).

Several tariff increase scenarios were analyzed, and their distributional impact on households was assessed, modulating the price increase by consumer category according to the existing tariff structure. Instead of actual household electricity consumption, for which accurate data were not available in 2018, the affordability of selected electricity consumption bundles was estimated. This estimation was made for households with access to grid electricity as well as for a hypothetical scenario with universal access (to account for socioeconomic changes in the customer base if and when all households receive electricity access). The analysis considered two different spending thresholds according to which affordability of electricity consumption could be assessed (that is, spending thresholds for electricity of 3 percent and 5 percent of total expenditures[21]) as well as two different growth scenarios for estimating the increase in household income (a uniform increase in line with expected inflation and a more conservative scenario to avoid underestimating the impact on the poor).

In parallel to the analysis of the total price increase on affordability, analysis of the impact of the 2018 and 2019 actual nominal price increases on poverty was conducted, including the indirect impacts on households through the electricity price increase to nonresidential users. Although the 2019 price increase for commercial and industrial users was limited to a nominal 5 percent, on average (which was less than the average inflation rate of 9 percent at the time), it followed a 25 percent price increase for nonresidential users in 2018 for which the indirect effects were assessed to have been more significant because they affected all households (compared with the direct effects affecting only the households connected to the grid, which are the wealthiest part of the population).[22] To take into account the indirect effects, technical coefficients between sectors were prepared using a social accounting matrix from 2014, later disaggregated and updated to 2016, and mapped to household consumption expenditure. Then, using data from the household survey, the additional expenditures due to these indirect effects were calculated for each household as a share of total expenditure under a price-shifting model. The increase in poverty due to both direct and indirect effects was estimated.

Ultimately, the Government of Guinea decided on an intermediate tariff increase scenario between scenarios 2 and 3, with a cumulative increase of 182–195 percent for residential consumers (15.5–16.3 percent per year, limited to 6.2 percent for the social bracket), and 45 percent for nonresidential consumers (4.8–5.4 percent per year). In the meantime, because scenarios were still being assessed, electricity tariffs for residential users were increased by 15 percent in May 2019, except for tariffs for the social bracket, for which the upper bound was reduced from 60 kWh/month to 40 kWh/month, and this social tariff became available only to domestic users consuming less than the threshold.[23]

[21] The Sustainable Energy for All framework defines 5 percent of total expenditure as an affordability threshold (Bhatia and Angelou 2015); however, because of the simultaneous burden of coal and wood expenditures for cooking, a 3 percent threshold for electricity affordability is also considered for this analysis, as per Briceno-Garmendia and Shkaratan (2011), who compare both thresholds for their affordability study in 27 Sub-Saharan African countries.

[22] See also Batana (2019) for a broader fiscal analysis, subject to the same data limitations.

[23] Although these increases are nominal for residential consumers in each bracket, the change in the usage threshold from 60 kWh/month to 40 kWh/month for the social bracket and the availability of the tariff only for those below the threshold since 2019 has more significant consequences on consumers above the newly revised threshold. In particular, the price increase for households consuming between 40 kWh/month and 80 kWh/month is much higher than the nominal increase estimated in the analysis.

TABLE 3.2

Guinea: Tariff Schedule for Residential and Nonresidential Low-Voltage Customers, 2008–21

Tariff regular		Consumption Blocks	Fixed Charge, Single-phase	Fixed Charge, Three-phase	Tariff 2008	Tariff 2018	Variation in variable tariff 2018/2008	Consumption blocks[a]	Tariff 2019	Variation in variable tariff 2019/2018[a]	Fixed Charge, Single-phase	Fixed Charge, Three-phase	Tariff 2021[b]	Variation in fixed charge 2021/2019	Variation in variable tariff 2021/2019[b]
		2008 to April 2018					**May 2018**	**May 2019**			**October 2021**				
		kWh/month	**GF/month**	**GF/month**	**GF/kWh**	**GF/kWh**	**%**	**kWh/month**	**GF/kWh**	**%**	**GF/month**	**GF/month**	**GF/kWh**	**%**	**%**
Residential clients, LV / Single-phase	T1	1 to 60	4,850		90	90	0	1 to 40	90	0	10,000		107	206	19
	T2	61 to 330	4,850		232	255	10	41 to 330	293	15	10,000		387	206	32
	T3	Above 330	4,850		265	292	10	Above 330	336	15	10,000		453	206	35
Residential clients, LV / Three-phase	T1	1 to 60		14,550	90	90	0	1 to 40	90	0		20,000	107	137	19
	T2	61 to 330		14,550	232	255	10	41 to 330	293	15		20,000	387	137	32
	T3	Above 330		14,550	265	292	10	Above 330	336	15		20,000	453	137	35
Commercial, LV (Single and Three-phase)		1 to 330	5,240	15,720	802	1,000	25	1 to 330	1,050	5	10,000		1,169	191	11
		Above 330	5,240	15,720	1,243	1,560	26	Above 330	1,638	5		20,000	1,823	127	11
Tariff prepayment								**Registered Power**	**Tariff 2019**				**Tariff 2021**		**Variation in tariff 2021/2019**
									May 2019				October 2021		
								kVA	GF/kWh				GF/kWh		%
Residential clients, LV / Single-phase								1.1 to 3.3	255				387		52
								4.4 to 9.9	347				453		31
Residential clients, LV / Three-phase									359				453		26
Commercial, LV / Single-phase									1,430				1,728		21
Commercial, LV / Three-phase									1,486				1,823		23

Source: Authors' elaboration using Government Decrees for 2008, 2018, 2019, and 2021.
Note: GF =Guinean Franc; kVA =kilovolt-ampere; kWh = kilowatt-hour; LV =Low Voltage; T1 = 1st block; T2 = 2nd block; T3 = 3rd block.
a. Reduction of T1 from 60 to 40 kWh/month.
b. Tariff switched to volumetric: the tariff for the block corresponding to the final month of consumption is applied to all consumption.

In 2021, after a period in which low-consumption households[24] received free electricity as part of pandemic-related support measures, electricity tariffs were increased by another 32 percent for residential consumption (limited to 19 percent for those in the social bracket), and fixed monthly charges increased for all user categories (from 4,850 to 10,000 GF/month for low-voltage single-phase users).[25] Detailed tariff schedules are presented in table 3.2.

3.1.3 Data Availability, Constraints, and Solutions

A key challenge for the distributional analysis was related to data. Significant adjustments of the household survey data used in the analysis were required across various parts of the analysis. The latest data available at the time of the analysis was from the 2012 household survey, Enquete Legere pour l'Evaluation de la Pauvrete, which was not fully representative of the electricity situation in 2018. Major changes to electricity access rates and sales by the utility had occurred between 2015 and 2018. In 2012, only 21 percent of households were connected to the grid, but by 2018 coverage was estimated to have reached 29 percent, largely thanks to regularization of illegal connections and metering of shared connections. This survey did not provide data on households that had been connected to the grid after 2012. EDG data indicated that average electricity consumption per residential user in Conakry also increased by 80 percent between 2014 and 2018 (a 16 percent increase per year), reaching 255 kWh/month, on average.[26] The increase in billed consumption reflected increased power generation (by 270 percent between 2013 and 2017 according to data available from the utility) allowing electricity rationing, which had been a major issue, to be reduced. Improved metering and billing also helped: EDG increased the number of formal connections (mostly by reducing informal connections), expanded metering, and adjusted the methodology for billing unmetered consumers (incorporating hours of use). Therefore, to better estimate the impact of a tariff increase on expenditures, expenditures recorded in the 2012 survey had to be adjusted to 2018 levels to reflect changes in electricity access rates and consumption.

The analysis based on 2012 data was sensitive to the assumptions used to adjust these data to 2018, the base year, on the one hand, and to 2025 for the various tariff increase scenarios, on the other hand. Total household expenditure figures were adjusted for inflation for the period 2012–18 to construct the baseline, then two scenarios were considered for the period 2018: a homogeneous growth assumption and a more conservative assumption according to which the expenses of the poorest increase by only half compared with the rest of the population, to take into account nonuniform variations

[24] Households consuming less than 330 kWh/month were provided electricity free of charge as part of the pandemic measures; the threshold was later decreased to 250 kWh/month to limit coverage of the measure (IMF 2020).

[25] The doubling of the fixed charge can also have a larger impact on lower consumers, although this was not part of any of the scenarios analyzed. For a household consuming 40 kWh/month, the planned consumption tariff increase was 19 percent in 2021; however, the total bill would increase by about 70 percent because of the fixed charge increase. For a household consuming 60 kWh/month (the previous lower bound of the first block), the monthly bill would increase from 22,430 GF (about US$2.4) to 33,220 GF (about US$3.6), thus about a 50 percent increase.

[26] Note that this average consumption comes from the total amount of electricity supplied by EDG to domestic users divided by the number of official domestic connections and strongly overestimates the actual average consumption at the household level (because of theft and multiple connections).

across time according to the standard of living.[27] At the same time, household electricity expenses increased substantially between 2012 and 2018, as documented by EDG data, and electricity expenditure recorded in the 2012 household survey was adjusted to approximate EDG's data, as noted earlier.

Census and utility data were used to update electricity access rates. In Enquete Legere pour l'Evaluation de la Pauvrete 2012, 85 percent of the households in Conakry stated that they had access to electricity through an EDG connection, 8 percent through a neighbor, and 2 percent otherwise (only 6 percent reported no access at all); and 70 percent stated that they used grid electricity for lighting. In the 2014 census, there was no direct question on access, but 76 percent of Conakry households reported using electricity from the EDG grid for lighting, which was far more than indicated by EDG customer data at that time. Because of the mismatch between census and EDG data (mainly resulting from

[27] As evidenced in the Systematic Country Diagnostic for Guinea, consumption growth was not pro-poor between 2007 and 2012: the consumption growth rate declined from the poorest to the wealthiest decile, showing negative numbers for most households. The poor living in urban areas had the largest drop in consumption during this period (World Bank 2018).

informal connections and shared billing), household electricity expenditure data did not correctly reflect consumption at the household level. Electricity access, and hence consumption data, was also limited for rural households outside Conakry, where access was rare. The 2014 census indicated that only 20 percent of all electricity users outside Conakry were in rural areas (based on the proxy of using electricity for lighting)

In addition to the data challenge resulting from households sharing connections, which misrepresents the relationship between recorded expenditure and actual electricity consumption per household, another limitation was imposed by the lack of metering, which is a very common issue in Sub-Saharan Africa, as demonstrated by Kojima et al. (2016). In 2012, most residential electricity users in Guinea were unmetered, and households were billed a fixed amount based on capacity and electrical appliances used by the household. Under the 2015–19 management contract with Veolia, meters have been installed in Conakry and about a third of residential users were metered in 2017.

In view of constraints in connection and consumption data available from the household survey, the affordability analysis was conducted for selected electricity consumption thresholds (40, 60, and 80 kWh/month). It was assumed that, following the large-scale metering campaign, the tariff would apply to each household and connections would not be shared by multiple others,[28] even though the fixed charge would represent a significant part of electricity bills (about 50 percent of the bill for a metered household consuming 60 kWh/month in 2018).

3.1.4 Main Findings and Lessons Learned

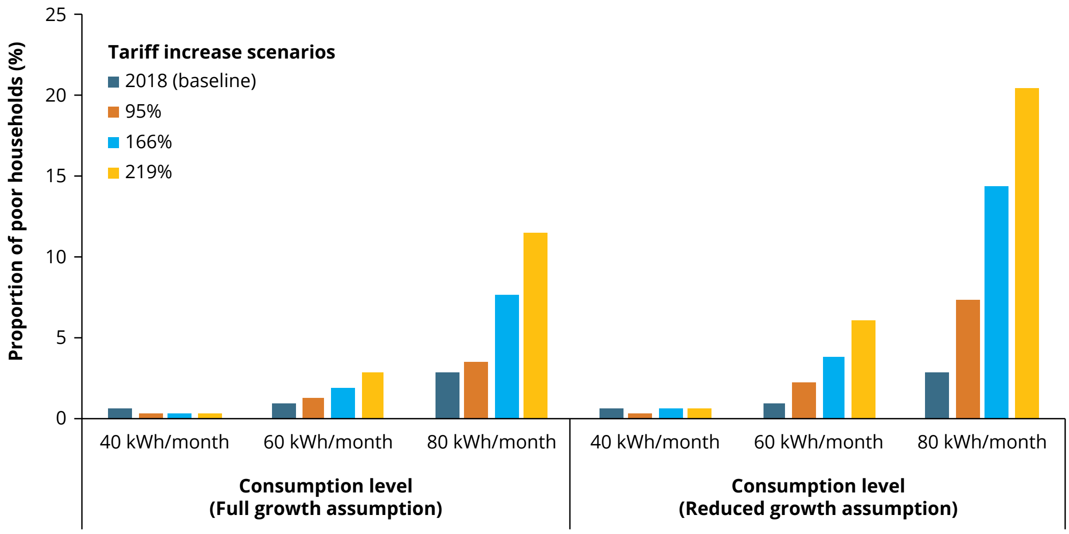
The distributional analysis indicated that electricity consumption would remain affordable for households already connected to the electricity grid (mainly households in the capital, Conakry) for all tariff increase scenarios, and for all the basic electricity consumption bundles considered.

For poor rural households and households in secondary cities, which were mostly unconnected at the time of the analysis, affordability of electricity, assessed at the threshold of 3 percent of total household expenditures, had the possibility of becoming an issue in the higher price increase scenario, as shown in figure 3.1. According to the analysis, when lower growth rates were assumed, up to 20 percent of households would spend more than 3 percent of their household budget to pay for a consumption level of 80 kWh/month. If incomes were to grow in line with inflation, the proportion of poor households whose consumption would be above the affordability threshold would be reduced to 11 percent.

[28] The assumption of individual metering remains a simplifying assumption for a context such as the Guinean one, where shared connections are common among the poor. The 2021 increase of the fixed charge from 4,850 GF to 10,000 GF per month will provide even more incentives for households to share a meter.

FIGURE 3.1

Guinea: Poor Households above Affordability Threshold, by Consumption and Tariff Scenario



Source: Authors' calculations based on updated Enquete Legere pour l'Evaluation de la Pauvrete 2012.
Note: Affordability threshold is 3 percent of total household expenditure. The full growth assumption assumes uniform income growth in line with expected inflation; the reduced growth assumption is more conservative, with poor households' income increasing by half the expected inflation growth rate. kWh = kilowatt-hour.

A lower consumption level of 60 kWh/month would remain affordable for most poor households. Because the first 40 kWh consumption block has been protected from higher increases (the price increase in this bracket is lower than inflation), this consumption level would remain affordable for all poor households under all increase scenarios conducted.

Alternatively, considering a 5 percent affordability threshold as used in the Sustainable Energy for All Framework (Bhatia and Angelou 2015),[29] consumption of up to 80 kWh/month (the estimated average consumption) would remain affordable for all poor households under all tariff increase scenarios assessed. The analysis indicated that regardless of which tariff increase scenario is chosen to bring tariffs closer to cost-reflective levels, a subsistence consumption level could benefit from being spared from significant tariff increases, and it is critical for poor households to have the ability to control their billed consumption through actual metering or a specific fixed fee based on household equipment or electric features. It is worth noting that the scenarios assessed at

[29] Bhatia and Angelou (2015, 75), in their work Beyond Connections: Energy Access Redefined, define affordability as follows: "To be affordable, a stipulated [electricity] consumption of 365 kWh per year [about 30 kWh/month] should cost less than 5 percent of the household income." A 3 percent threshold is also commonly used for Sub-Saharan Africa (Briceno-Garmendia and Shkaratan, 2011).

the time did not include a switch to a volumetric tariff (where the social tariff is available only to consumers below the threshold), which would have a high impact on households consuming just above this usage threshold, whether large households or households sharing meters, nor did the assessments include any increase in the fixed charge.

The actual 2019 price increase for residential users was limited to 5 percent, on average; thus, the total estimated impact remained insignificant, even after including indirect effects on poverty incidence through the impact on the prices of other goods as estimated through an additional analysis that was part of a Poverty and Social Impact Analysis. Because this increase followed a 25 percent price increase for nonresidential users in 2018, the combined direct and indirect effects of the 2018 and 2019 increases on poverty were estimated at 0.15 percentage point. There is also an effect on the poorest (households that were already poor before the price increase) through the increased expenditures, thus on poverty severity: the poverty gap increased by 0.11 percentage point.

The analysis indicated that investing in social safety nets could prove very important in channeling direct support to low-income households facing issues of electricity affordability as electricity access is expanded. Indeed, the expansion of the country's social assistance programs was one of the government's priorities under a three-year IMF Extended Credit Facility signed in December 2017, along with a commitment to gradually reduce untargeted electricity subsidies to create fiscal space for public investments in infrastructure and to strengthen social safety nets. The government expressed its intention to use part of the savings from the electricity tariff reform to scale up social assistance programs in 2019 and mitigate the impact of the increase in petroleum product prices (through targeted cash transfers to poor households in urban and peri-urban areas, the most affected by the increase in petroleum product prices) as well as for labor-intensive public works (IMF 2019).

The case study for Guinea highlights a situation in which modeling was needed to simulate alternative reform scenarios in a context with substantial data challenges. In this case, publicly funded indirect electricity tariff subsidies, representing about 1.7 percent of GDP—about the size of public spending for education—were providing benefits to a limited share of the population already connected to the grid, while at the same time expansion of electricity access to poorer households remained a national priority. The methodological approach chosen was useful for understanding the distributional impacts of price reform in a data-constrained setting by adjusting household data to the time frame of the reform. The detailed analyses carried out as part of this exercise contributed to the government's own analysis and decision-making by limiting the price increase for low electricity consumers in the path to cost recovery.

3.2 Analysis of Electricity and Fuel Subsidies as Part of a Broader Fiscal Incidence Assessment: Indonesia, 2014–18

This case study was selected to illustrate a broad distributional analysis of fiscal policy using a CEQ approach to assess direct and indirect effects of fiscal policy tools, including consumption taxes and energy subsidies.

This approach was especially useful in highlighting the fiscal magnitude and distributional impact of energy subsidies relative to other, more effective and pro-poor social programs. Given the substantial indirect effects of fuel subsidies on prices of all other goods and services, this case also demonstrates the usefulness of a limited general equilibrium approach to account for those indirect effects in addition to the direct effects from households' fuel consumption.

3.2.1 Background and Context

Energy subsidies in Indonesia were estimated to be equivalent to 3.7 percent of GDP in 2012 at the time of the analysis, corresponding to about 23 percent of total government expenditure.[30] These subsidies were almost as much as total social spending on priorities such as education, health, direct cash transfers, and contributory pensions, which amounted to 25 percent of total expenditure. In the 2014–15 period, the government of Indonesia introduced ambitious reforms to reduce untargeted energy subsidies and reallocate expenditures to programs that reduce inequality and foster balanced economic growth (Jellema, Wai-Poi, and Afkar 2017). Among measures taken were the removal of subsidies for low-octane gasoline, the reduction of the subsidy on diesel, and approval of electricity tariff increases for several consumer categories. In 2017, the conditional cash transfer program increased to 10 million beneficiaries (Tiwari et al. 2020). With all these measures, the aggregate energy subsidy figure decreased from 3.7 percent of GDP in 2012 to 1 percent in 2018. This section summarizes the approach and key findings from the two analyses carried out in the context of World Bank support to the government of Indonesia. The most noteworthy findings of the analysis were related to the regressivity of untargeted energy subsidies and the inefficiency with which it supports the bottom of the income distribution.

[30] In 2021, energy subsidies in Indonesia bounced back to 2.7 percent of GDP (see appendix A for the fossil fuel subsidy variation in US dollars between 2010 and 2021 using IEA data).

3.2.2 Analytical Approach and Methodology

While developing the 2014–15 reforms, the government of Indonesia carried out analyses of government spending, including for electricity and fuel subsidies, as part of an analytical exercise with support from the World Bank. In the analysis, the government used a CEQ approach to assess the direct and indirect effects of consumption taxes and energy subsidies. The analysis was part of a broader distributional analysis of fiscal policy.

The direct impact on households of energy subsidies that affect retail prices is relatively straightforward to estimate using household expenditure data by making assumptions about the economic incidence. But the same subsidies also affect the costs of intermediate goods used as inputs for production of other goods and services. Through their impact on the prices for intermediate goods, subsidies indirectly affect consumer prices for other goods and services. This happens when producers pass some of these higher or lower input prices on to other producers or to final consumers. Considering only the direct effects of the subsidies would provide an incomplete picture of this intervention's welfare impact and underestimate the effect on poverty and inequality. The indirect effect from the cost of production of other goods can be larger than the direct impact, and proportionally more important for lower-income consumers (chapter 2 provides further detail on this subject). For example, in a 20-country study (Jellema and Inchauste 2018) covering several regions across the globe, the indirect effect of higher fuel prices on welfare accounted for nearly 60 percent of the aggregate impact. The same study also assessed that the indirect impact of the fuel subsidies was about 34 percent larger than the direct impact for the bottom two quintiles of the population. Indirect effects are especially important to consider when evaluating the effects of petroleum products in developing countries, especially at the bottom of the income distribution.

For Indonesia, the CEQ analysis incorporated five types of energy subsidies: electricity and four different fuels (gasoline, kerosene, diesel, and gas). The analysis was carried out using 2012 data, at which point energy subsidies were at their highest. According to 2012 data, the largest share of subsidies was provided for gasoline (52 percent of total subsidies, not including indirect effects), while electricity subsidies accounted for 33 percent of total subsidies, gas 11 percent, kerosene 3 percent, and diesel less than 1 percent.

As part of the analysis, the incidence of government expenditure on energy subsidies was compared with social spending, mostly in the form of direct cash transfers, contributory pensions, and in-kind transfers. With energy subsidies included, about 57 percent of total primary government spending was covered in the incidence analysis. The CEQ working paper (Jellema, Wai-Poi, and Afkar 2017) provides an overview of the approach followed and findings from this analysis.

3.2.3 Data Availability, Constraints, and Assumptions

The analysis had to overcome several data challenges and convert existing data into the elements required for the CEQ analysis. For example, detailed data on taxes on households was not available for direct use in the analysis. To determine the size of the transfer received or the taxes contributed by households and individuals, taxes and transfers were allocated to individual households using data from the household survey (the 2012 Indonesia National Social Economic Survey) and statutory rules for each tax survey. The 2012 household survey contained information on household expenditures, cash transfers, and utilization of educational and health services collected from about 71,000 representative households across the country over the entire year.

The indirect effect of consumption taxes or energy subsidies was calculated using the cost-push method (Jellema and Inchauste 2018) and an input-output table for the Indonesian economy as of 2011. For Indonesia, as is typically done under CEQ, consumption taxes and energy subsidies—for fuels and electricity—were shifted forward to consumers, assuming that consumers had perfectly inelastic[31] demand for goods and services. This approach corresponds to the assumption that economic incidence of these taxes and transfers is fully on consumers.

The direct effect of energy subsidies was calculated by multiplying total household expenditures by the subsidy rate, which is calculated as the difference between the government's "reference" price and the sale price (which is widely publicized and easily verified) as a percentage of the reference price. For the fuels, the weighted average of the subsidies was about 51 percent of the market price. In practice, reference or cost-recovery prices are available in official decrees or administrative documentation (such as regulatory decisions, reports, and independent assessments) or other sector analytical work, while in other cases additional analysis needs to be undertaken to calculate appropriate reference prices.

For the indirect effects of the fuel subsidy, a cost-push regime was assumed for all economic sectors: if input prices change for producers as a result of policy or regulatory decisions, those producer price changes are pushed on to the final sale price of the good or service under assessment. In the Indonesia CEQ analysis, this effect was

[31] The assumption of inelastic demand is a standard simplifying assumption for general equilibrium models. This assumption can be interpreted as no reaction of demand to the change in price.

estimated using a cost-push model for all sectors of the economy, which is equivalent to simulating a situation in which subsidies are completely removed in the fuels and electricity sectors to assess the full impact of those indirect effects. For fuels, the average increase in prices was assumed to be 105 percent to bring prices to cost-recovery levels (and elimination of subsidies that accounted for 51 percent of total cost). For electricity, the increase in prices was assumed to be 62 percent (corresponding to elimination of the weighted-average subsidies for industrial consumers).

3.2.4 Main Findings and Lessons Learned

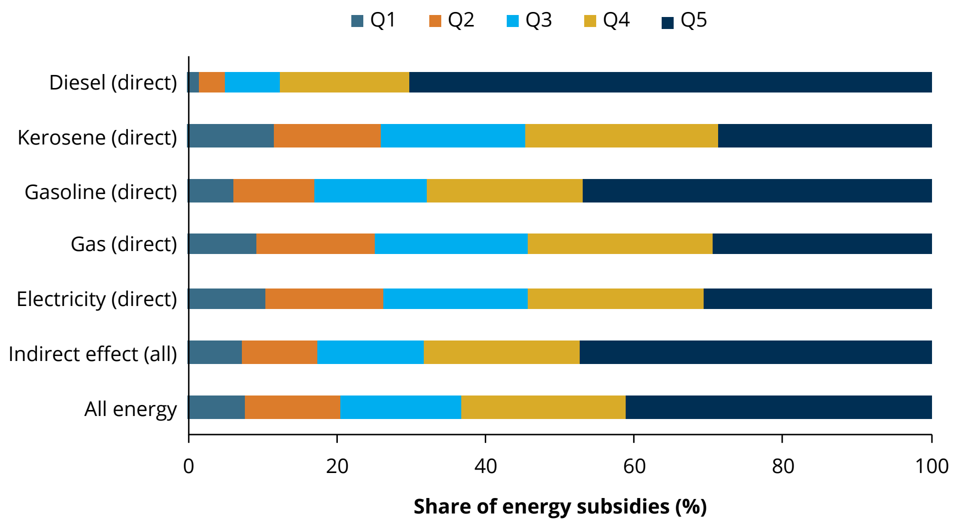
Use of the CEQ approach to assess the distributional effect of energy subsidies offers the opportunity to analyze the subsidies in the broader context of other fiscal and social interventions of the government. For Indonesia, it was particularly useful to compare the distributional impact of energy subsidies with spending on direct transfers and education, both of which received a smaller share of government spending.

According to the Indonesia CEQ assessment, conducted using 2012 data, direct transfers had, collectively, larger marginal impacts on inequality than energy subsidies, although energy subsidies received a total budget allocation 10 times the allocation for direct transfers. In particular, education had an impact on inequality more than 10 times greater than the impact of energy subsidies, even though energy subsidies received a budget allocation that was one-third as large as the education budget. The assessment found that inequality neither increased nor decreased with energy subsidies, and there would be only a marginal change in the Gini index. As explained by Jellema, Wai-Poi, and Afkar (2017), from a distributional perspective, cash and near-cash transfers, energy subsidies, and in-kind transfers in health and education were all found to be progressive in relative terms with respect to market income. However, transfers provided via energy subsidies or in kind were regressive in absolute terms, which means that households that were consuming either more (as for energy subsidies) or higher-value types (as for tertiary education or health) received proportionately larger shares of the transfers available.

The analysis rendered interesting findings regarding the impact that government expenditure on energy subsidies had on inequality and poverty. Although up to 3.7 percent of GDP had been spent on energy subsidies in 2012, this expenditure made the lowest contribution to reducing inequality, meaning the cost-effectiveness of energy subsidies was close to zero for inequality reduction (World Bank 2015b). On the other hand, the impact of energy subsidies on poverty reduction (4 percentage points in 2012) was estimated at approximately four times the impact of direct transfers (1 percentage point). The coverage of direct transfer beneficiaries was low before the fiscal reform, with small transfer amounts relative to income; consequently, the impact on poverty from direct transfer expenditures was modest. Energy subsidies had a larger impact on poverty, but the magnitude of subsidy expenditures was much larger than for direct transfers. Considering that the budget allocation for energy subsidies was more than 10 times that

FIGURE 3.2

Indonesia: Distribution of Energy Subsidies by Income Quintile, 2012



Source: Authors' calculations based on 2012 National Socioeconomic Survey data.
Note: "Indirect effect (all)" means effects coming from fuel and electricity subsidies on other consumption goods.

for direct transfers, the analysis revealed the inefficiency of energy subsidies as a means of poverty reduction compared with direct transfers.

Another advantage of the fiscal incidence approach is the flexibility it offers for the presentation of results. After running the simulation code, the analyst can produce the results in any breakdown that might be of interest, such as by type of household, region, or location. One common indicator that is usually analyzed is the absolute incidence or targeting of the program, that is, share of the program budget that goes to each quintile.

The incidence analysis shows that the subsidies were highly regressive overall and also for each type of energy, with most of the energy subsidies benefiting the well-off. The results for the incidence of energy subsidies in Indonesia in 2012 are presented in figure 3.2. About 40 percent of total subsidies was estimated to have accrued to the top quintile whereas the share of energy subsidies received by the bottom two quintiles was 20 percent. Gasoline subsidies—the largest component of energy subsidies in 2012 (53 percent)—were even more regressive in this sense: 47 percent benefited the top quintile. This can be explained by the fact that better-off households are more likely to have cars, and hence consume more fuel compared with poorer households. Diesel subsidies were found to be the most regressive, but they accounted for the smallest amount among all subsidies. Other subsidies, including for electricity, were found to be more evenly distributed. For electricity, the bottom first and second quintiles received 10 and

15 percent of total energy subsidies, respectively, and 31 percent of the total benefit accrued to the top quintile.

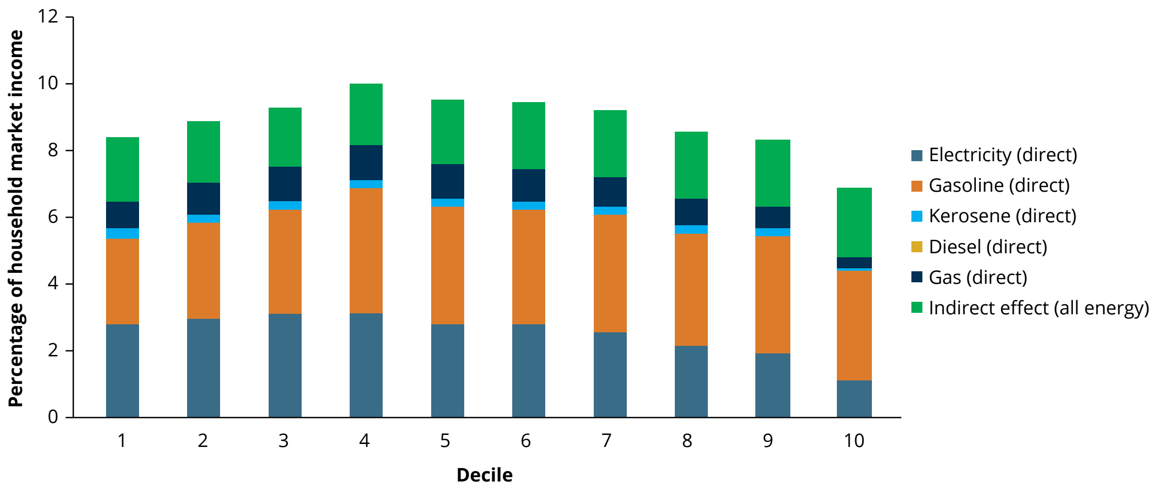
For Indonesia, the largest effect relative to market incomes came from electricity and gasoline subsidies. They accounted for 33 and 52 percent, respectively, of the total energy subsidies received directly by households through their energy consumption (26 and 40 percent, respectively, if indirect effects of the subsidies on other goods are included). The indirect effects accounted for another 23 percent of total subsidies provided to households.

Subsidies were found to contribute to slightly larger shares of incomes of the poor and vulnerable. If calculated as a share of market income, subsidies were slightly larger for the bottom four deciles than for the top six (see figure 3.3). Because energy subsidies represented about 9–10 percent of household market income for most Indonesians, removing them would have a nontrivial impact and requires adequate mitigation strategies to protect the most vulnerable (World Bank 2015b).

The Indonesia case study provides an example of a broader approach to assessing the distributional impact of fiscal policies using the CEQ framework (Lustig 2018). For Indonesia, the CEQ framework includes the analysis of electricity and fuel subsidies for which government spending was higher than spending for education or health before the 2014–15 fiscal reform. This approach was especially useful in highlighting the size and

FIGURE 3.3

Indonesia: Relative Incidence of Energy Subsidies by Market Income Decile, 2012



Source: Author's calculations based on 2012 National Socioeconomic Survey data.

distributional impact of energy subsidies relative to government expenditure on other, more effective, programs. Given the substantial indirect effects of fuel subsidies on the prices of all other goods and services, this case also demonstrates the usefulness of a partial equilibrium approach to account for indirect effects when significant fuel subsidies are involved. In addition to the regressivity of energy subsidies as evidenced in the analysis, their impact on poverty and the share of income they represent underlines that affordability issues need to be tackled alongside improvement of targeting.

Since the assessment, the government of Indonesia has implemented ambitious reforms to fossil fuel subsidies, including removing the subsidy for low-octane gasoline, lowering diesel subsidies, and increasing electricity tariffs for several consumer categories. As a result, government spending on energy subsidies decreased from 3.7 percent of GDP in 2012 to 1 percent in 2018, creating fiscal space for other social programs. In 2017, coverage of the conditional cash transfer program had expanded to 10 million beneficiaries. Nonetheless, Indonesia's spending on targeted social assistance programs is lower than in countries with similar levels of income, and more work would be necessary to understand the extent to which cash transfer programs made up for the removal of energy subsidies.

3.3 Distributional Analysis of Direct Effects: 2014–16 Energy Tariff Reforms in Ukraine

This case study was selected to illustrate the use of distributional analyses to assess the direct effects of energy reform. The Ukraine case is a good example of adoption of an integrated approach to assessing short-term distributional impacts of energy tariff reforms as part of broader sector reforms and the use of these analyses to strengthen the design of the reforms themselves, in particular, mitigation measures.

This case study is primarily based on data on the state of Ukraine's energy sector and reform program in the 2014–16 period and describes sector conditions at the time of the analysis. To illustrate reform impacts, supplemental information from subsequent periods is provided, where feasible. Nonetheless, it is worth noting that the Russian invasion of Ukraine has caused significant changes to the country and to the energy sector, including impacts on poverty and welfare, infrastructure damage, energy supply shocks, and sector financial status. Future analysis will be needed to understand the aggregate impact of this disruption on poverty, welfare, and inequality in Ukraine.

3.3.1 Background and Context

This case study focuses on the use of distributional analysis to estimate direct effects of energy price reform options and help mitigate the impacts on households in the context of a massive tariff increase for gas and district heating. To illustrate this approach, the case study reviews the analysis of the energy tariff and subsidy reform that took place amid the severe economic crisis of 2013–15 in Ukraine. This analysis was carried out as part of the World Bank's analytical advisory support to the government of Ukraine in the context of energy sector reforms over several years, with funding from ESMAP.

During the 2013–15 crisis, Ukraine's economy experienced a deep recession and depreciation, and compression of current public expenditures contributed to a significant contraction of disposable incomes, with both labor and nonlabor incomes declining in 2015 in real terms. As a result, poverty reverted to 2010 levels, with the estimated poverty rate (those living on less than US$5/day in 2005 purchasing power parity terms) increasing from 3.3 percent in 2014 to 5.8 percent in 2015, and moderate poverty[32] increasing from 15.2 percent to an estimated 22.2 percent. Labor market conditions deteriorated, with nominal wage growth lagging behind inflation, and real wages down, on average, by 20 percent in 2015. Joblessness, access to services, social tensions, and livelihoods more broadly were particularly impacted in conflict-affected areas (World Bank 2017).

Before the energy sector reforms, the combination of high energy intensity and low residential tariffs for gas and district heating resulted in a significant fiscal burden for the government of Ukraine in the form of quasi-fiscal and budgetary subsidies.[33] The quasi-fiscal subsidies were mainly due to underpricing of energy, in the form of below-cost-recovery tariffs for gas and district heating for residential users, as well as low gas prices for district heating utilities. These subsidies for energy utilities were equivalent to up to 6.6 percent of GDP in 2013 and kept increasing with gas import costs, climbing to 10 percent of GDP in 2014. In addition to the high fiscal burden from subsidizing an imported fuel, the energy subsidies encouraged overuse by households and hindered investment in energy efficiency or cleaner sources of energy. To tackle the unsustainable fiscal burden from energy subsidies, the government of Ukraine implemented a series of tariff increases between 2013 and 2016. The sector moved from highly regressive tariff

[32] To obviate the methodological shortfalls of the official methodology using the statutory Subsistence Minimum, the World Bank introduced in 2016 a new poverty line, based on a new consumption aggregate and the cost-of-basic-needs methodology. This is the line adopted to present "moderate poverty" estimates, set in 2014 prices at 1,045 hryvnias per month, which is equivalent to US$8.5 a day in 2005 purchasing power parity terms (World Bank 2017).

[33] Quasi-fiscal subsidies are generally calculated as the difference between the cost of production at cost-recovery prices and the actual cost to end users. In Ukraine, because the commodity cost of gas is driven by the market value of the marginal supply source of natural gas, 65 percent of which was imported before the reform, the economic value of gas has been set to the commodity cost of imported gas (World Bank 2013). Quasi-fiscal subsidies do not translate into an actual cost to the government but to opportunity costs (see Saavalainen and ten Berge [2006] for a discussion of the quasi-fiscal deficit, especially in former Soviet Union countries).

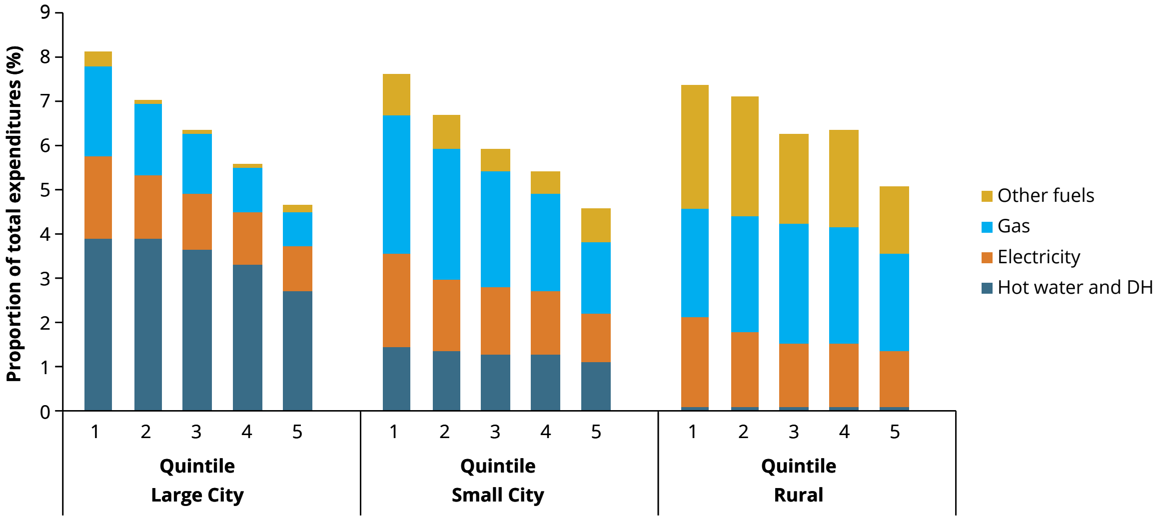
subsidies to targeted transfers through the Housing and Utility Subsidy (HUS) program as a measure to mitigate the impacts of the successive tariff increases. As part of these reforms, average residential tariffs increased 700 percent for natural gas and 140 percent for district heating from 2013 to 2016. These reforms delivered a significant decline in the quasi-fiscal deficit, which dropped to about 2 percent of GDP in 2017, down from a high of 10 percent of GDP in 2014.

Despite low energy prices, the energy burden was significant for poorer households, who spent a higher share of their resources on energy bills than the rest of the population, with energy expenditure patterns reflecting the energy sources for heating in different locations. Households in large cities mostly relied on district heating and gas, while those in smaller cities and rural areas relied mostly on gas. The price subsidies disproportionately benefited richer households with higher consumption. According to an earlier distributional analysis carried out as part of World Bank technical assistance to the government of Ukraine, a quarter of total residential gas subsidies accrued to the wealthiest quintile, while the poorest received only about 13 percent of energy subsidy spending in 2011 (World Bank 2013). According to household survey data, in 2013, poorer households (the bottom 30 percent) devoted, on average, almost 8 percent of their total expenditures to energy, versus less than 6 percent for the upper 70 percent of households. Moreover, a significant share of poor households spent more than 10 percent of their total budget on energy, the conventional threshold for energy poverty[34]—up to 27 percent of the poorest quintile in large cities, and 22 percent of the poorest quintile in small cities and

[34] The 10 percent threshold was originally defined in the United Kingdom to measure "fuel poverty," with reference to twice the median consumption of low-income households, but it has since been used rather mechanically as opposed to in reference to a specific context (Olivier and Ruggeri Laderchi 2018)

FIGURE 3.4

Ukraine: Energy as a Share of Total Expenditures by Income Quintile, 2013



Source: Authors' calculations using Household Living Conditions Survey 2013.

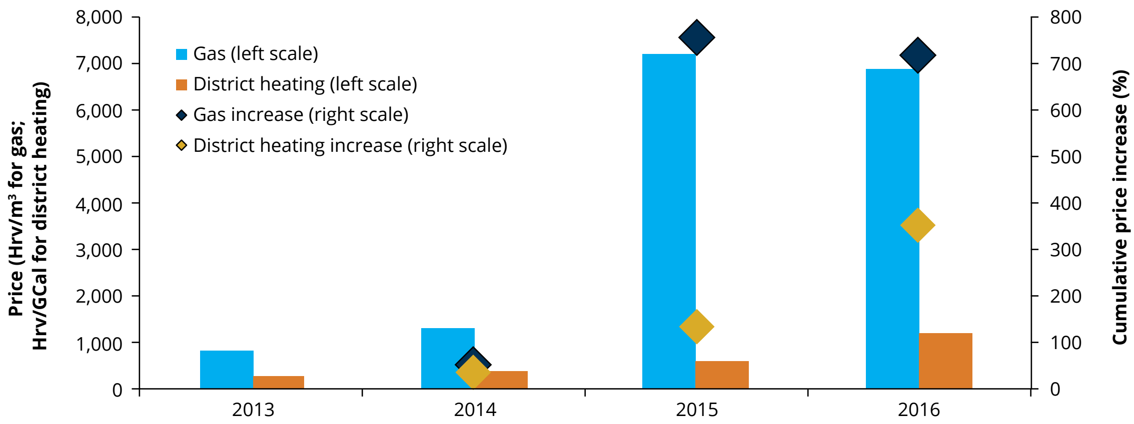
rural areas (at the national level, the proportion is 14 percent of households). Figure 3.4 presents total energy expenditures as a share of total expenditures by wealth quintile[35] and the type of fuel used in each area, before the successive energy price increases.

As part of a three-year transition plan to cost recovery,[36] average gas and district heating tariffs increased in 2014 (by 56 percent and 40 percent, respectively), and in 2015 a substantial residential gas tariff increase was implemented (a nominal increase of 450 percent, with a seasonal lifeline for households heating with gas), as was an increase in the district heating tariff (of 70 percent). Eventually, the devaluation of the hryvnia offset the 2015 tariff increases.[37] In May 2016, the transitional lifeline tariff for consumers heating with gas was abolished and a uniform tariff reflecting the import parity price was adopted. In parallel, electricity tariffs were increased twice a year from

[35] Wealth quintiles are defined by total expenditures per capita.
[36] The government approved the Gas Sector Reform Implementation Plan in 2015; energy tariff increases and strengthening of social assistance mechanisms are essential parts of the plan. The plan was developed by the Ministry of Energy and Coal Industry, the Ministry of Social Protection, and the Energy Regulator.
[37] The currency depreciated by 47 percent in 2014 and a further 33 percent in 2015 (World Bank 2017).

FIGURE 3.5

Ukraine: Gas and District Heating Nominal and Cumulative Tariff Increases, 2013–16



Source: Calculations based on National Energy and Public Utilities Regulatory Commission official data.
Note: GCal = gigacalories; Hrv = Ukrainian hryvnias.

2015 to 2017.[38] Figure 3.5 shows the cumulative gas and district heating tariff increase from 2013 to 2016 (in nominal terms), each applied after the heating season.

The rapid expansion of the HUS program, which reached almost half of the country's households by 2016, helped mitigate the impact of the price increases. Overall, spending on social assistance rose from 3.4 percent of GDP in 2014 to 4.4 percent in 2017 because of the significant expansion of the HUS program, which grew from 0.2 percent of GDP to 2.3 percent over the same period (World Bank 2020). By 2018, the government of Ukraine was spending about 4 percent of GDP on social assistance programs, far above the average for the Europe and Central Asia region.

Most energy-related assistance was consolidated into the HUS program, which delivered mostly in-kind subsidies in the form of discounts on household utility bills. Before the reform, the HUS as originally designed covered the difference between a maximum threshold of 15 percent of the income of eligible households and their social norm–adjusted consumption for all types of utilities.[39] As a result, the HUS automatically increased with energy prices. With the reform, the HUS was modified to introduce a strong element of targeting and the program was then scaled up. Coverage of the HUS program rapidly increased in 2015, reaching 44 percent of households by 2016. Several adjustments

[38] Gas and district heating tariff increases were applied in May and July, respectively, after the heating season (the first quarter of the year accounted for roughly half of annual gas consumption). Therefore, average increases year over year were lower than the nominal increase applied in 2014 and 2015, while the average increase for 2016 was higher than the nominal one. In total, the average increase between 2014 and 2016 totaled 470 percent for gas, 155 percent for electricity, and 190 percent for district heating, while the inflation rate was about 70 percent during the same period.
[39] Social norms are coefficients linked to the characteristics of the dwelling and of the technology and equipment being used and define reference consumption for each household based on demographic and housing characteristics.

BOX 3.1

UKRAINE HOUSING AND UTILITY SUBSIDY PROGRAM AND THE SOCIAL PROTECTION REFORM

The original Housing and Utility program in Ukraine comprised the Housing and Utility Privileges program, which provided a discount on utility bills for certain categories (children of war, war veterans, Chernobyl disaster victims) and the Housing and Utility Subsidy (HUS) for households living under one statutory Subsistence Minimum per capita. Subsidies for solid fuels were provided in cash whereas utility subsidies were provided as discounts on utility bills.

During the 2015–17 period, when the HUS was expanded to all households (most eligibility conditions were lifted) and provided benefits to cushion the impact of utility tariff increases while the Housing and Utility Privileges program was gradually phased out, the HUS program became the country's largest social assistance program, reaching close to half of the country's households (6.5 million) in 2017. In 2018, the HUS absorbed the largest share of the social assistance budget (48.4 percent). From 2018 to 2020, the government of Ukraine took steps to improve the targeting accuracy of the HUS and gradually contain the program's costs. The subsequent scaling down of the HUS led to a reduction in overall social assistance spending from 4.4 percent of GDP in 2017 to 3.8 percent in 2018, and the number of households benefiting from the HUS dropped from about 7 million in 2017 to fewer than 4 million in 2018.

Measures to downscale the HUS program focused on changing its parameters to reduce its coverage and improve its targeting. This effort required revising consumption norms (in 2014 then again in 2016) and optimizing the HUS benefit formula by increasing the mandatory out-of-pocket payment share parameter in the HUS benefit formula from 15 percent to 20 percent and strengthening fraud and error control. This reform has also strengthened incentives for HUS beneficiaries to spend less than the normative consumption of energy-related utility services through energy saving and to invest in energy-efficiency measures. New eligibility rules for the HUS restricted the provision of excessive energy subsidies, resulting in lower household energy consumption, and in 2019, the HUS program eventually made the transition to monetization.

(continued)

BOX 3.1, CONT.

Following the 2022 Russian invasion, the Cabinet of Ministers of Ukraine passed resolutions to secure HUS cash transfers for beneficiaries (3.3 million households in 2019) and granted the HUS amount for the duration of the period of martial law without the need to apply monthly (Byrnes 2022).

Sources: Encyclopedia of subsidies (http://sobes.ua/ua/baza-znan/entsiklopediya-subsidij#, retrieved February 14, 2017); World Bank 2020.

have been made to the formula to achieve a more progressive distribution: a sliding scale has been added to decrease the maximum threshold for lower-income households while increasing the threshold for wealthier ones; in parallel, the social norms on the basis of which the amount of the transfer is determined were tightened to better reflect actual consumption (see box 3.1 for details of the reforms to the HUS program).

3.3.2 Analytical Approach and Methodology

The analytical approach focused on ex ante assessments of the potential impacts of tariff reform options carried out through successive rounds of analysis using micro-simulations. In each round of analysis (carried out as part of broader World Bank technical advisory support to the government of Ukraine, including through ESMAP funding) three main calculations were performed. First, the distribution of existing energy subsidies was assessed. Second, the direct effects of the energy tariff increases on households were assessed. Third, mitigation mechanisms through the revised HUS program were simulated. Each of these steps is described in detail below.

The first step of each round was to construct a baseline to obtain a pre-reform reference as the counterfactual for the year analyzed. Each round of simulations used the latest household budget survey available and adjusted the income and expenditures variables to the year of analysis by either using a uniform growth and inflation adjustment, or, starting in 2014, using data available by decile from the national statistical office, Ukrstat,[40] which improved the analysis. The adjusted total income was critical as a reference for the calculation of the poverty rate and the housing subsidies provided by the HUS social assistance program. Thereafter, the impacts of two types of energy subsidies were simulated before and after reform: the estimated tariff subsidies on the one hand, provided through underpricing (based on total energy expenditures and the gap between current and reference prices), and the HUS on the other hand, recalculated using the adjusted income and the new energy tariffs. For each tariff increase, HUS eligibility was automatically adjusted for a given threshold (initially 15 percent but subject to modulation), as was the total HUS amount offered based on the social norms (normed consumption level), household characteristics, and additional HUS coverage assumptions. The impact of the price increase on households was measured by the welfare loss, as indicated by increased expenditure as a share of total expenditures (corresponding to the Laspeyres variation under an assumption of constant consumption).

To evaluate the initial price subsidy distribution in the baseline and in each price increase scenario, the analysis used a price gap approach, and the subsidy for each energy source (gas and district heating) was defined as the difference between the reference price and the actual unit price, multiplied by quantity consumed:

$$\text{Subsidy} = \Delta\ \text{Price} \times \text{Quantity},$$

where ΔPrice is the difference between the reference price and the unit price charged to residential users, and Quantity is the quantity of gas (in cubic meters) or heat (in gigacalories) used. The reference price for gas was the import parity price, according to the government's price reform financial models, and the cost recovery price was used for district heating. Because unit prices were not uniform across households, the analysis used the official tariffs for residential users. For gas, the calculation took into account that until 2014, the average gas unit price depended on total annual consumption, with different tariffs charged to the two main user categories, metered and unmetered (in 2013, almost 50 percent of the households were unmetered, based on utility data).[41] Because district heating tariffs also varied across households, districts, and local suppliers, average tariffs by region were used.

3.3.3 Data Availability, Constraints, and Solutions

The distributional analysis undertaken in the context of the energy subsidy reform process encountered numerous data availability challenges. The government of Ukraine and the World Bank teams carrying out the distributional analysis of the options under consideration adopted an approach and assumptions to overcome these challenges.

[40] Household Living Conditions Surveys have been conducted every year in Ukraine, with four quarterly rounds. Expenditures available for the analysis were the totals of the four quarters (except for 2012, for which quarterly data were available). However, there usually was a two-year delay before household survey microdata became available. For the assessment of the impact of the price increase, the original baseline was constructed using the 2013 survey, prior to the 2014 and 2015 price increases.

[41] Until 2014, a volumetric tariff was applied for gas with a threshold at 2,500 m3/year (this threshold roughly separated households using gas for heating from the ones using gas only for cooking and hot water). After 2014, the structure was changed to an increasing block tariff for households heating with gas and a flat price for others. In 2015, as a transition period, a lifeline tariff for households heating with gas was implemented and then lifted in 2016 after the heating season.

TABLE 3.3

Ukraine: Data Sources for Simulations of the Energy Subsidy Reform Options

Household Budget Survey data (HLCS 2013, 2014, and 2016)	Administrative data
• Per capita net income and household size • Detailed housing and utility cash and in-kind expenditures • Housing characteristics (type of heating, equipment, size of household, and size of dwelling	• Utility tariffs and financial models cost-recovery and import parity prices • Social protection data on norms • Monthly income data and Subsistence Minimum (from Ukrstat) • Utility data on consumption by quarter

Source: Authors' elaboration.
Note: HLCS = Household Living Conditions Survey.

The approach the distributional analysis took to address some of the complexity and data challenges are summarized in this section.

The assessment of the potential distributional impacts of subsidy reforms required detailed modeling of tariffs and social norms at the household level; consumption and the corresponding expenditures were estimated using the Household Living Conditions Survey.[42] Detailed modeling of changes in social benefits provided through the HUS program was also required, and it used information from the Ministry of Social Protection and from utilities and the regulator. Additional administrative and utility data were required for the household-level modeling, as presented in table 3.3.

- **Household expenditure.** As a first step, to estimate the total quantity of energy consumed, total household expenditure data had to be reconstructed for each utility using the relevant tariff schedule and energy-related household characteristics (metered or unmetered, gas-fired equipment, electrical equipment, and so on). Total expenditure by each utility was calculated according to the following formula:[43]

  Total expenditure = Cash expenditure + HUS (cash or in-kind) + Privilege (cash or in-kind)

- **Subsidy per household.** Household eligibility for HUS benefits was determined based on consumption thresholds and norms defined by the government. Monthly consumption norms were defined for each utility and level of housing expenditures, with specific norms for each type of electrical or heating equipment, based on dwelling surface area and number of persons in the household. Until 2014, the maximum or "mandatory"

[42] Crimea was excluded from the statistics after 2013, while the conflict-affected areas in the eastern part of the country were still included, albeit imperfectly.
[43] The Housing and Utility Privileges program was another kind of energy subsidy provided by the social assistance program to certain categories of households in the form of discounts on housing and utility bills or cash for liquefied and solid fuels. This categorical kind of subsidy was progressively phased out with the expansion of the HUS, and the population covered decreased from 25 percent in 2013 to about 6 percent in 2018.

payment by households toward the bill for the total of the normed housing and utility consumption could not surpass a threshold of 15 percent of total household income. For eligible households, the HUS covered the portion of the energy bill that was equal to the total normative consumption above the threshold, irrespective of actual consumption. To estimate the amount of total housing and utility benefits to be covered by the HUS, the following formula was used for each household:

$$\text{Total Subsidy} = \text{Total Norm adjusted bill} - 0.15 \times \text{Total household income.}$$

Then the subsidy amount for each energy service, whether gas, district heating, or electricity, was calculated based on each energy bill calculated for a normed consumption as a proportion of the total normed housing and utility bills (see box 3.1 on Ukraine Housing and Utility Subsidy Program and the Social Protection Reform).

In 2014, a sliding scale threshold was used so that poorer households benefited from a lower threshold than wealthier ones (the reference threshold was 15 percent for a household with income per capita equal to twice the statutory Subsistence Minimum),[44] yielding the revised benefit formula:

$$\text{Total Subsidy} = \text{Norm adjusted bill} - 0.15 \times \text{Total household income} \times \left(\frac{\text{Total household income)}}{2 \times \text{Subsistence Minimum}}\right)$$

- **Assumptions about the tariff increase applied.** The official nominal tariff increases as presented earlier are average increases across users; however, price increases at the household level varied significantly because of the lack of uniformity in the initial price structure. To better reflect the actual change for households, actual prices were applied to gas, district heating, and electricity users based on the actual price structure, household equipment, and reported expenditures.

- **Adjustments for seasonality of demand.** The strong seasonality of energy consumption posed a critical methodological challenge. Because heating represented a significant portion of energy consumption, the HUS monthly norms varied for energy used for heating and nonheating purposes, and consequently across users and seasons. Properly reflecting the seasonality of demand in the analysis posed a data challenge, because household survey data on expenditure was in the form of annual aggregates, while consumption, and hence subsidies, at the household level varied monthly and had to be calculated separately for the heating and nonheating seasons. Recognizing this constraint, the analysis drew on seasonal energy consumption data from Naftogas, the main gas utility, to impute the distribution of consumption across the year. In addition, nominal tariff increases were applied in the middle of the year, after the heating season, and generated a reference tariff that was substantially different than the annual average, given the high increase. Another tariff issue came from the lifeline tariff applied in 2015 for the first 200 cubic meters of gas used per month, which was a

[44] In Ukraine, the Subsistence Minimum (SM) is established every year for different categories of persons by the law on the state budget. Tax rates and most social benefits depend on the official value of the Subsistence Minimum.

transitory measure during the first heating season (and only for households heating with gas). This measure was removed in 2016 after the heating season.

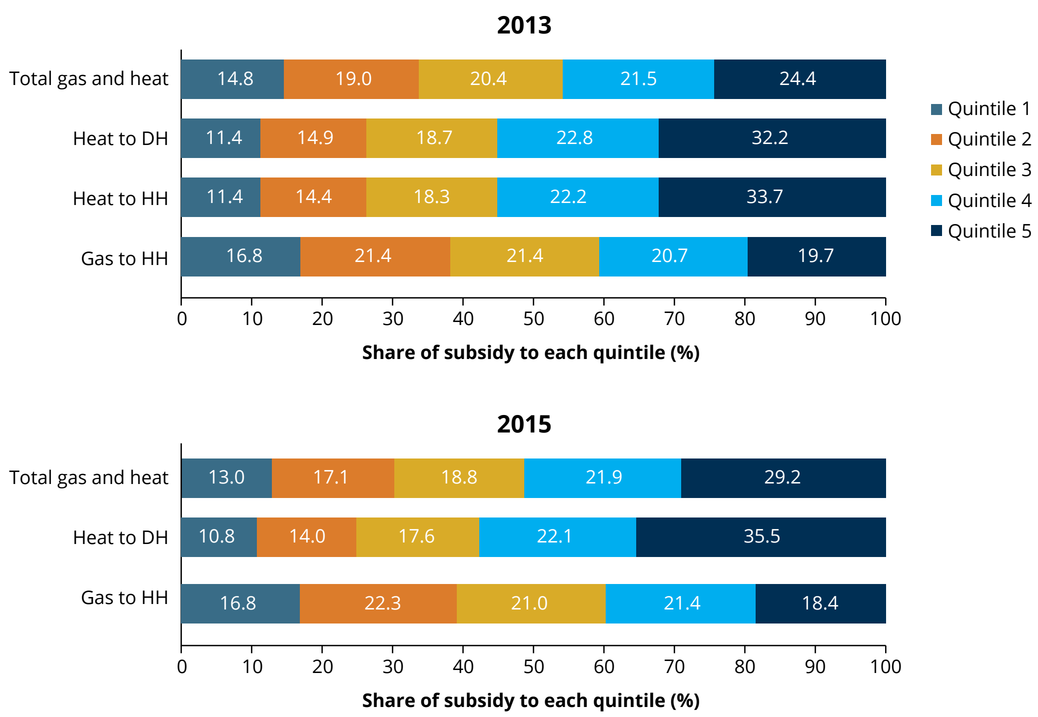
- **Assumptions about consumer responses to price changes.** Recognizing the challenges in drawing conclusions about the price elasticity of demand in a context of high price increases coupled with high compensation,[45] all simulations were conducted using a conservative assumption that held consumption levels constant and used total expenditures, including HUS provision, which means housing and utility expenditures before the HUS subsidy was subtracted. Sensitivity analyses for price elasticities of households with metered consumption were conducted as a robustness check.[46] The analysis also did not include the possible effects of nonpayment, which had been expected with further restrictions on HUS eligibility. On the other hand, post-reform data showed that, on average, gas and heating consumption actually declined over the reform period while metering coverage was expanded. Utility data showed that residential gas consumption decreased by 6 percent, on average, in the first quarter of 2016 compared with 2015. District heating consumption also decreased for several reasons, including installation of meters.
- **Assumptions about provision of HUS to households.** Even before the revision of the HUS rules (thresholds and norms), HUS eligibility was directly affected by the price

[45] In addition to the magnitude of the price change (see Bacon [1995] for issues associated with large price shifts in the power sector), a specific issue for the demand estimation was that the average gas price for the user benefiting from the HUS depended on their consumption, causing endogeneity issues and bias.
[46] Alberini, Khymych, and Ščasný (2020) and Alberini and Umapathi (2021) estimate gas price elasticities in Ukraine using the HUS subsidy in 2017 and 2018 to get a price variation across households once metering was extended to most gas users, and found very low elasticities of −0.16 and −0.17 (these estimates remain subject to potential endogeneity issues given that the average price depends on consumption).

increase. Households whose normed consumption was below the 15 percent threshold before the price increase could reach the eligibility threshold after the price increase. Two extreme scenarios were considered to provide an idea of the breadth of possible outcomes in terms of number of beneficiaries and the social assistance budget. Under the first, "no expansion," scenario, only households who were already receiving the HUS would apply for and receive the benefit if eligible under the new tariffs. This was a very conservative estimate given that coverage eventually expanded over the period. Under the "full expansion" scenario, all households that were eligible for the benefit would receive it. This scenario did not consider possible constraints on the supply side in the provision of the programs. Both scenarios assumed that perfect knowledge of household income was available, enabling perfect targeting of the programs.

FIGURE 3.6

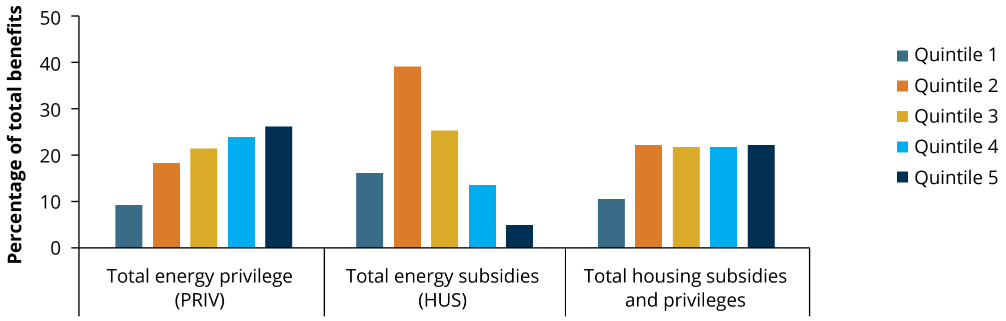
Ukraine: Distribution of Price Subsidies by Income Quintile, 2013 and 2015



Source: Authors' calculation using Household Living Conditions Survey 2013 and utility data.
Note: DH = district heating; HH = households.

FIGURE 3.7

Ukraine: Distribution of HUS and Housing and Utility Privileges before the Reform (2013)



Source: Authors' calculation using Household Living Conditions Survey 2013.
Note: HUS = Housing and Utility Subsidy program; PRIV = Housing and Utility Privileges program.

3.3.4 Main Findings and Lessons Learned

The distributional analysis confirmed that the gas and district heating price subsidies provided before the reform were highly regressive. After the reform, gas tariffs became less regressive, near neutral, while district heating remained regressive given that gas sold to district heating companies continued to be below cost-recovery prices. In 2013, only 15 percent of the direct and quasi-fiscal subsidies were provided to the poorest quintile while 24 percent went to the wealthiest (see figure 3.6). In 2015, only 13 percent of the combined gas and district heating price subsidies were provided to the poorest quintile (World Bank 2017).

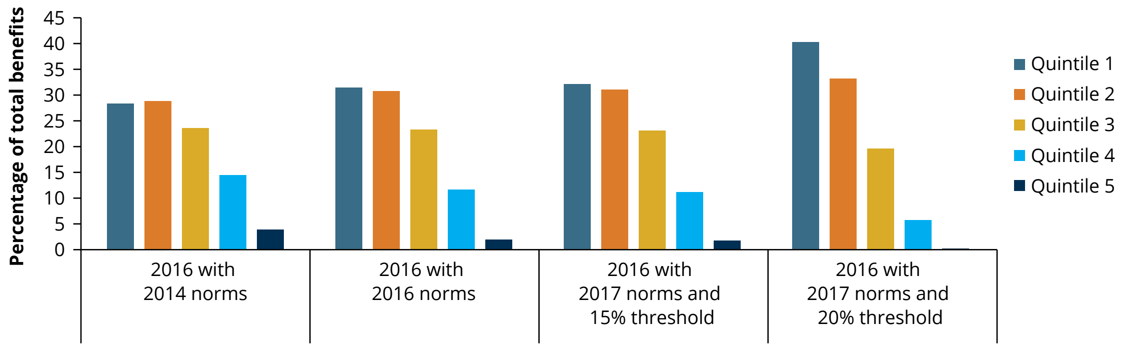
The most regressive subsidies were those provided through the district heating tariff (about 11 percent of the district heating subsidy went to the poorest quintile, whereas 32 percent went to the wealthiest in 2013) and these subsidies remained largely in place in 2015.[47] The regressivity of such price subsidies with rather uniform pricing stems directly from the distribution of access and usage because district heating is unevenly distributed and provided mostly in larger cities.

An interesting finding of the analysis was that the existence of a lifeline rate for gas could not guarantee the progressive distribution of the gas price subsidies. This finding is particularly relevant for poor households in single family buildings in rural areas with very little insulation and highly inefficient heating equipment, which limited their ability to adjust their consumption levels. It is estimated that, as a consequence, the gas subsidy became quasi-neutral in 2015 (and not progressive, as expected with the lifeline).

[47] In 2015, the district heating subsidy provided through the underpricing of gas to district heating companies was eliminated, but the subsidy to households through underpricing of district heating remained until 2016.

FIGURE 3.8

Ukraine: Distribution of Simulated Benefits



Source: Authors' calculation using Household Living Conditions Survey 2013.
Note: Norms are social norms for housing and utility consumption. Thresholds are the thresholds for the benefit formula, fixing the maximum percentage of total expenditures a household should pay for housing and utilities normed consumption.

A subsequent analysis conducted at a later stage by the World Bank as part of continuing technical assistance to the government of Ukraine also estimated that, had the currency devaluation not occurred, the gas subsidy would have covered only the portion of consumption below the lifeline during winter and would have been slightly more progressive according to the ex post simulations.

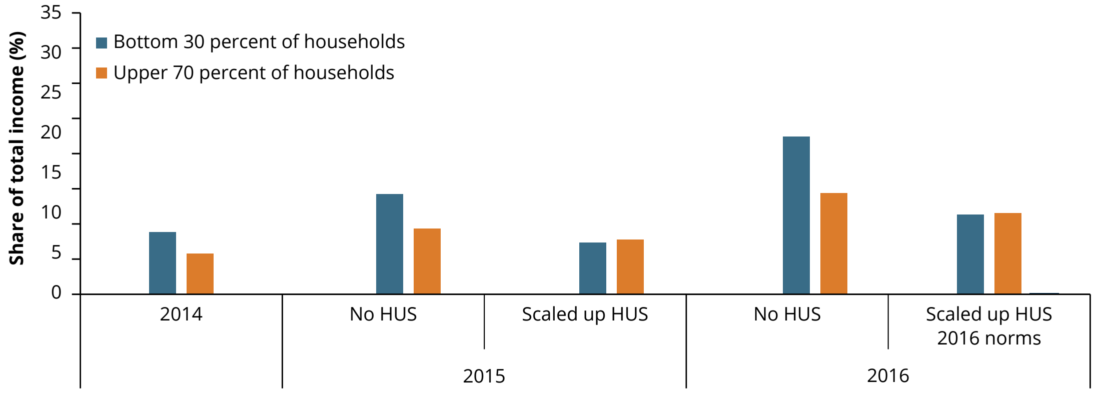
By contrast, the HUS, the program that provided direct energy subsidies through the social assistance system, which was the main tool with which to address the distributional impact of the tariff increase, became much more progressive than before the reform. It is estimated that only 16 percent of the HUS benefits were accruing to the poorest quintile in 2013 (see figure 3.7) when HUS coverage was very limited. Simulations were conducted with alternative thresholds and norms and showed that this share would increase to 30 percent when the HUS program was extended to most eligible households, as shown in figure 3.8, especially as the applicable norms were tightened, and increased to 40 percent when the maximum threshold increased to 20 percent of income (more than 50 percent of the poorest quintile became eligible under the original social norms).[48]

In addition to the progressivity of transfers, more indicators are necessary to assess the impact of the reform on households for which energy affordability and poverty are significant issues: scaling up the HUS program successfully mitigated the impact of the energy price increases introduced in 2014 and 2015, maintaining the affordability of

[48] Note that actual data from Household Living Conditions Survey 2016 show that 55 percent of the poorest quintile received benefits from the HUS program in 2016 versus 24 percent of the wealthiest quintile. Coverage of the program grew from 8 percent of the population in 2013 to 42 percent in 2016.

FIGURE 3.9

Ukraine: Simulation of Shares of Energy in Household Expenditures, by Income Group



Source: Authors' calculation using Household Living Conditions Survey 2013.
Note: HUS = Housing and Utility Subsidy.

energy bills for most households and limiting the rise in the poverty headcount. Further simulations show, in figure 3.9, that without the HUS program, average energy expenditures as a share of total household expenditures would have topped 20 percent in 2016 for the bottom 30 percent of households. The program actually reduced this share to 10 percent (for the bottom 30 percent as well as for the upper 70 percent). In addition, according to additional World Bank simulations, the impact of energy price increases on poverty rates was limited to a 4 percentage point increase between 2014 and 2016, compared with an estimated possible 10 percentage point increase without the provision of the HUS benefits. (The political and economic crises resulting from the invasion have led to an increase in poverty far above these estimates; see World Bank [2017]).

Thanks to the revision of the benefit formula for calculating the HUS—applying a sliding scale for the eligibility threshold—more low-income households became eligible for the subsidy as their housing and utility expenditures, both normative and actual, increased and exceeded their specific threshold. In parallel with the expansion of coverage, the generosity of benefits also increased. The administrative data showed that up to 44 percent of households were actually covered in 2016 (up from 4 percent in 2014). Alongside the program expansion, consumption norms were reduced in 2016 and 2017.

The scaling-up of the HUS, together with the adoption of a gradual tariff increase trajectory toward import parity, rather than a one-off, significant tariff hike, were explicitly part of a transition strategy to allow time for households to adapt to higher tariffs. Further rounds of simulations conducted in 2017 estimated the fiscal needs for various scenarios of changes in the eligibility criteria, the distributional impact of different alternatives, and the poverty impact of reducing transfers under those scenarios, and helped to calibrate the assistance required.

On the other hand, the large scale and generosity of the HUS program is assessed to have contributed to strong disincentives for consumers to reduce energy consumption or invest in energy-efficiency measures. The subsequent changes in the parameters of the HUS to reduce its coverage and improve its targeting created fiscal space for the expansion of the means-tested Guaranteed Minimum Income Program as part of an ambitious social safety net reform designed to support poverty alleviation (the HUS budget decreased from 2.15 percent of GDP in 2017 to 1 percent in 2020). In the meantime, the subsequent stages of social protection reform were intended to strengthen incentives for HUS beneficiaries to spend less than the normative consumption through energy saving and investment in energy-efficiency measures (Alberini and Umapathi 2021; World Bank 2020).[49]

Overall, the Ukraine case illustrates an integrated approach to assessing the short-term distributional impacts of energy subsidy reforms and use of distributional analyses to strengthen the design of the reform. The simulations clearly demonstrated the importance of social protection and mitigation measures as a central part of the reform. The iterative rounds of distributional impact simulations, which were adjusted at the household level to take into account subsidy delivery mechanisms and were fine-tuned over time, were a critical element of the analytical work that supported delivery of the reform. Where data constraints posed challenges, the analysis was strengthened through recalibration of existing data to align it with methodological requirements, and assumptions that were made were tested through sensitivity analysis. The analysis served as a critical tool in improving the design of the household utility subsidy, supporting the effort led by the Ministry of Finance and the Ministry of Social Protection, and fostering collaboration among experts from different spheres, including energy, poverty, social protection, and macroeconomics. The HUS program became a critical component of the social safety net program, helping to effectively protect households from the harshest impacts in the transition period of the reform.

[49] Alberini and Umapathi (2021) provide an analysis of the welfare impacts of the Ukraine HUS and estimate that the loss of welfare would remain moderate if the HUS were reduced proportionally to all recipients, and "social tariffs" were applied, charging higher gas prices to wealthier households and using the extra revenue to help cover the bills of poorer households. Alternatively, they suggest converting the HUS to a one-time payment to be applied to energy-efficiency improvements in the dwelling, ensuring sustained, permanent savings in the energy bills of the household.

3.4 Qualitative Approaches Complementing Quantitative Analysis: Uzbekistan, 2015

This case study was selected to illustrate the use of a qualitative analysis to understand the distributional impacts of energy subsidies, as a complement to quantitative sectoral analyses when data access and quality constraints prevailed. This case study discusses the state of Uzbekistan's energy sector in 2015 and describes the sector conditions at the time of the analysis. Following the ambitious reform program initiated in 2017, there have been major changes in energy sector performance, subsidy reforms, and energy sector transformation. Therefore, this section emphasizes that the observations reported in the qualitative analysis findings apply to a certain period and the information presented was accurate at that time.

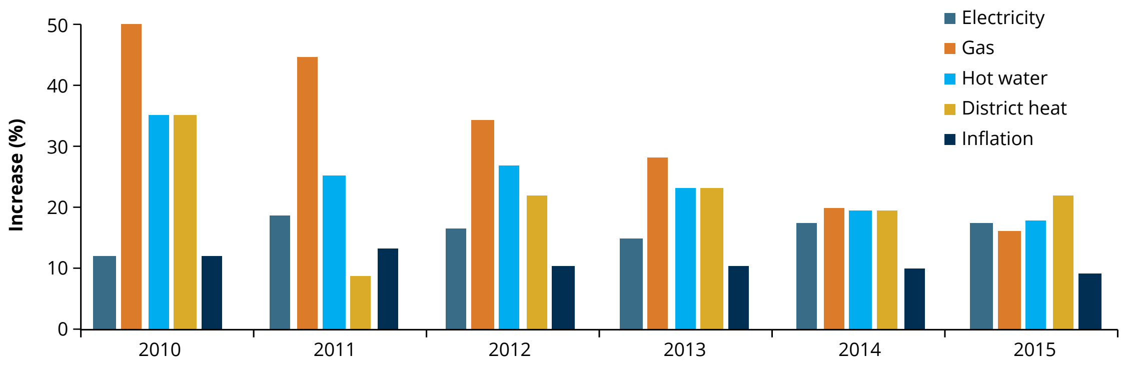
3.4.1 Background and Context

In the early 2010s, Uzbekistan's economy faced high energy intensity, poor energy efficiency, and fiscal pressures. At the time, the country was among the most energy inefficient economies worldwide, with energy consumption per unit of GDP three times the Europe and Central Asia region average (World Bank 2021). The energy supply mix has been dominated by fossil fuels, in particular natural gas, which accounted for 82 percent of the total primary energy supply in 2013, and oil and coal contributed 10 percent and 3 percent, respectively (Kochnakyan et al. 2013). Three main centralized energy services were provided to households, small enterprises, and social buildings: electricity, gas, and district heating systems (which includes residential hot water). Available statistics indicated that electricity was the most widely available service and that network coverage kept up with population growth. Gas supply networks were reported to be extensive (up to 90 percent population coverage) but did not reach all parts of the country, and coverage had declined in real terms as of 2015 (CER-UNDP 2015). District heating system coverage was more limited, reaching about 75 percent of the population in 2013 according to government data.

By 2015, service quality and availability challenges were experienced by consumers of centralized energy services in Uzbekistan. Energy consumption subsidies had climbed to 25.3 percent of GDP in 2012, among the highest in the world at the time. The levels of implicit subsidies for electricity were estimated at about 29 percent of the average long-run cost of supply (otherwise known as the price gap), and residential gas subsidies were about half the competitive market gas price in 2015. Tariffs have been brought closer to long-term cost recovery since 2018, but subsidies still represented 7.9 percent of GDP in 2019 according to the IEA. The annual tariff increases that took place between 2010 and 2015 were limited in real terms because of inflation, as shown in figure 3.10, and were

FIGURE 3.10

Uzbekistan: Annual Nominal Tariff Increases Compared with Consumer Price Inflation, 2010–15



Source: World Bank analysis based on official tariff data and World Economic Outlook inflation data.

insufficient to generate adequate sector revenues to meet operating costs or new investment needs.

According to a quantitative analysis conducted as part of a collaboration between the government and the World Bank in 2013,[50] **the distribution of implicit energy subsidies, especially heat and hot water subsidies, was found to be regressive at that time, with larger benefits accruing to wealthier households consuming more energy.** Meanwhile, energy expenditures as a share of total budgets were higher for households in the bottom quintiles, pointing to the vulnerability of low-income groups to tariff changes. The higher energy prices and larger energy expenditures were considered to contribute to an overall average reduction in welfare, which was likely more significant for households at the bottom of the distribution. The analysis also found that, even though the social benefit program provided utility bill payment support, there were weaknesses in the targeting.

Uzbekistan's social protection system had been gradually evolving since early 2003 to support the affordability of utility services, improve targeting efficiency, and introduce monetary compensation to predefined vulnerable groups, instead of the previous utility payment discount program called Privileges. Until 2015, there were two schedules of monetary compensation, 45 percent and 18 percent of the statutory Minimum Wage, with different eligibility requirements (39 percent of all recipients were in the 45 percent schedule). At the time of the study in 2015, despite the large number of household categories eligible for monetary compensation, the share of the population

[50] The quantitative analysis of the impact of the energy tariffs was conducted using the 2013 Central Asia Labor and Skills Survey (CALISS).

entitled to compensation under this mechanism had been declining and became negligible; as of 2015 about 0.4 percent of the total population received the utility bill compensation. The schedules were revised in 2015, and the values of compensation were increased to 50 percent, 45 percent, and 25 percent of the Minimum Wage. For beneficiaries, the value of the monetary compensation was significant as a share of average household expenditure; however, coverage remained low until the rollout of a Social Protection Single Registry, initiated in 2018 to improve the efficiency and effectiveness of social assistance.

3.4.2 Analytical Approach and Methodology

As part of a broader government of Uzbekistan and World Bank collaboration on the energy sector, which included, among other things, an assessment of the potential impact of energy price reforms, a qualitative study was conducted in 2015. A qualitative analysis was selected because the activity was being undertaken in a context of limited data availability, which made quantitative distributional analysis using traditional approaches impractical. Therefore, qualitative approaches were chosen as an alternative to help provide an understanding of the potential impact of energy tariff reform on different portions of society. It is important to note that, however, such an approach cannot be, and should not be used as, representative of the country but instead puts a special focus on income groups that are most likely to be vulnerable to the reforms and often underrepresented in national surveys.

The purpose of the qualitative assessment was to provide an understanding of household perspectives on and experience with centralized energy services, across a wide range of groups, with particular attention to low-income and vulnerable consumers. The assessment aimed to assess the potential impact of energy tariff reforms, consumer willingness to pay for improved service delivery, and consumer readiness for reforms. The assessment revealed important insights into the quality of energy services outside the capital city and demand for better services even at a higher price.

As part of the qualitative assessment, data were collected through 36 focus group discussions with households; 70 key informant interviews with utilities, national and local government representatives, consumer groups, and think tanks; and 13 household ethnographic interviews. Data were gathered from six geographically distinct regions, between September and November 2015. In each region (oblast), three research sites were selected based on the administrative level: one oblast center, one raion center, and one rural village.[51] In each of the 18 sites, two neighborhoods (mahallas) were chosen, and one focus group discussion was held in each mahalla.[52] Raion centers were selected to ensure they would represent diverse conditions— rural versus urban locations, distance

[51] The raion is the administrative subdivision of the oblast or region.

[52] A mahalla is the basic administrative unit of neighborhood local self-governance in Uzbekistan, administered by a mahalla committee (with a chairperson) and regulated by the government. Among their many activities in the community, mahalla committees distribute and make decisions on subsidies for low-income households and on family allocations for children. They also provide legal advice, settle family disputes, and sometimes provide material aid outside of government subsidies (World Bank 1999).

from oblast centers (close versus remote), and distance from centralized energy network (where such information was available). Rural villages were selected based on distance from the raion center (close versus remote). In addition to the 70 key informant interviews with stakeholder groups, separate interviews were held with low-income and middle-income households, men and women, and residents in apartments and private houses. Although not statistically representative of the country as whole, the data gathered from these qualitative methods contributed to an informative assessment across a range of distinct locations and population groups in Uzbekistan.

Customers for the qualitative analysis were classified according to centralized energy service access levels across the sample.

- Group 1: Households that receive *all available centralized energy services* in Uzbekistan (electricity, gas, district heating including residential hot water)
- Group 2: Households that receive only *centralized electricity and gas services*
- Group 3: Households receiving only *centralized electricity services*.

3.4.3 Analysis Findings and Conclusions

The 2015 qualitative study provided an overview and contributed to an improved understanding of consumers' perspectives on Uzbekistan's centralized energy services. Rather than seeking nationally representative information, the study provided information on energy end-users; supply and service quality experienced by consumers, along with costs; coping mechanisms; consumer attitudes toward energy costs; and willingness to pay for service improvements, with a specific focus on low- and middle-income groups, which were deemed likely to be vulnerable to the reform.

The assessment revealed some important insights about the sector, including the constraints on household energy access. In addition to electricity, which was available across all sample sites, access to centralized energy services and their quality was reported to be generally poor to moderate across many location types and regions outside the capital, Tashkent. In response to service reliability and quality issues, many households reported coping strategies that were inefficient and sometimes unsafe. Where one or more centralized energy services were unavailable, households substituted one centralized energy source for another. There were significant differences across energy services. All sampled households reported having access to electricity, which they assessed to be of better quality than the other services. Electricity was reported to be used as a substitute for gas (cooking) and district heating (space heating, water heating). Accordingly, electricity demand increased significantly during heating seasons. Interviews revealed increased demand that could overload electricity infrastructure and hence worsen quality of service. Many communities reported interruption of electricity service because of system overload. Gas was reported to be used as a substitute for district heating (space heating). Overall, other energy services were reported as not being easy substitutes for electricity. At that time, centralized gas services were available to approximately 70 percent of the sampled location types (including all oblast centers); however, two-thirds of rural villages in the sample were not supplied by any central gas system.[53] Focus groups indicated that the situation was common among other rural villages in the region. This is consistent with CER-UNDP (2015), which reports that centralized gas supply coverage was declining. Households reported using alternative energy sources when centralized energy was not available or did not function properly, particularly in rural villages and raion (peri-urban) central cities where respondents indicated substantially increased reliance on solid fuels during winter.

Payments for energy often constituted a significant proportion of total household expenditures. According to information provided by study respondents, between 10 and 20 percent of the annual household budget was spent on energy, but instances of energy expenditures rising to 50 percent of total household budgets for some low-income households during winter were also reported. All focus group participants in rural villages reported spending money on solid fuel and other noncentralized energy sources. In several rural villages and raion centers, households reported spending more on solid fuels and other noncentralized energy services than on centralized energy services. Middle-income households reported spending less on energy than low-income families as a proportion of their total household budget, suggesting that low-income households may have been unable to supplement centralized energy services with nonnetworked sources, and instead endured lower comfort levels. This information would not have been easily captured by regular quantitative studies based on current expenditures and suggests that an analysis based on the cost of energy subsistence level for the household (not actual level of energy consumption) should be conducted. Households with electricity as their only source of centralized energy spent as much on energy per year as households with access to all centralized energy services because they spent money on firewood, coal, and dried manure, which accounted for up to half of their total energy expenditure. Households with access to electricity and gas spent most of their energy budgets on centralized gas.

Household energy expenditures peaked during winter as a result of higher consumption and higher prices, often when incomes were the lowest for many households. Households reported that the inability to smooth consumption over the year placed a significant financial burden on those connected to centralized gas and electricity, with consumption peaking during winter when normative prices were higher. The costs for solid fuels exhibited even greater seasonal peaks than those for centralized energy services according to focus group participants. Prices were highest between November and January, when they could be multiples[54] of spring and summer prices. Furthermore, a lack of available cash in some smaller urban and rural centers, and a lack of storage options for solid fuels, could make it difficult to buy noncentralized energy sources. Households affected by energy service quality issues in the winter used a variety of coping mechanisms to maintain indoor temperatures during the coldest months. Some residents reported migrating to temporary living quarters to better cope with the cold. Some residents in Tashkent

[53] As of 2022, coverage and access rates have dramatically improved. Rural villages have access to centrally supplied liquefied petroleum gas. In the winter, electricity and liquefied petroleum gas have emerged as back-up options.
[54] Up to six times higher, as reported in some focus groups.

reported shifting from private houses in summer to apartments in winter, where indoor heating was better (for example, because of available district heating). In some rural areas, some residents moved to urban areas for the winter because of access to district heating or residential hot water.

Focus group discussions indicated that the impact of high energy costs on low-income households was significant: groups across many of the sampled areas reported reducing consumption and using energy more efficiently after increases in tariffs (except in Tashkent). Some low-income households reported self-rationing centralized energy services and shifting to solid fuels because of rising bills during winter. In an effort to reduce energy expenses, some low-income households reported avoiding using electric devices where possible. This information may also inform future quantitative analysis with assumptions on price elasticity, especially for low-income households. Some households reported delaying payments for centralized energy services because of the pressing nature of competing household expenditures.

The study revealed a lack of awareness of cleaner alternatives or energy-efficient options at the time. For instance, participants in rural areas were mostly unaware of energy-efficient appliances, such as light bulbs or household-level renewable energy systems, which were not available in the sampled smaller peri-urban and rural areas in 2015.[55]

Willingness to pay higher tariffs for improved energy services appeared relatively high, especially in areas with limited access to centralized energy services and those with poorer quality of centralized services. Moreover, respondents who were not connected to electricity or centralized gas reported higher willingness to pay to be connected, while those without district heating were not willing to pay to be reconnected. Households reported that energy tariffs increased twice a year, and the ones willing to pay higher tariffs stated that their willingness was conditional on improvements in the quality of energy services.

The study also explored whether preexisting social assistance programs would be suitable to support low-income households facing rising energy tariffs. Some focus group participants expressed concerns that existing social assistance programs may not be adequate to support the most vulnerable; they expressed concerns about eligibility criteria, low transfer amounts, and short duration of assistance. Focus group respondents noted that social support allowances may not be reaching all vulnerable households. For instance, some focus groups reported that an official certificate proving low salary or pension was required to accompany an application for certain benefits, and people not formally employed and without a pension could not provide such documentation and were therefore excluded.

[55] As of 2022, the situation had improved significantly, with almost all households, including those in the lowest quintiles, reportedly using efficient lighting and other appliances according to the 2022 Listening to Citizens of Uzbekistan survey (see https://www.worldbank.org/en/country/uzbekistan/brief/l2cu).

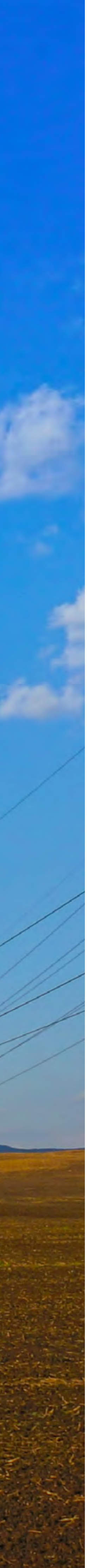
The qualitative assessment also revealed that many households, even among the poor, supported energy subsidy reforms if they would lead to improved quality of energy services. According to focus group discussants, these reforms would need to include changes in tariff policy and social assistance. Respondents were generally supportive of introducing block tariffs that provided lower rates for low-volume consumers. However, some respondents stated that block tariffs should be designed in a way to avoid penalizing poor households with large families. Among the reported priorities for improvements in electricity services, households wanted more transparent payments for electricity through the installation of prepaid meters, which would eliminate the need for inspectors to be involved in collections and would allow consumers to check their bill balance. For gas services, households prioritized increased gas pressure, especially during winter. Low gas pressure meant that households could not use gas for cooking and heating and they had to switch to solid fuels. Moreover, installation of gas meters (perceived to be more transparent and accurate than inspector-based fixed fees) and increased frequency and promptness of delivery of liquid gas cylinders from gas utilities were also highlighted.

The 2015 survey and qualitative assessment provided the government of Uzbekistan with useful information about household perspectives and an understanding of groups that may be more vulnerable to potential price reforms. Some of the factors revealed by the qualitative survey, such as select rural households' concerns about service quality, or the strong seasonality pattern of the energy expenditure burden on households, were not captured in the previous quantitative survey. As noted earlier, given the limitations of the approach and the specific focus on certain household groups, the interpretation of the results from the qualitative survey needs to be undertaken with a clear understanding of the groups surveyed and the bias that may arise by construction.

The government continued to strengthen and reform the energy sector and social assistance systems. Since 2016, the government of Uzbekistan has been improving social assistance systems and specific mechanisms to protect vulnerable groups from price shocks. In addition to the requirement for better data, improvements have involved better targeting tools (for example, proxy means testing) that use the existing social benefit system for low-income families with children, especially under the new Social Protection Single Registry, supported by a World Bank and UNICEF program. This program addresses the major challenges undermining implementation of the economic reforms and more especially the large proportion of poor families without any form of social and employment support under previous policies (World Bank 2019).

FOUR

Conclusions and Lessons Learned



An urgent policy reform challenge is being faced by countries affected by fiscal burdens and distortions resulting from energy subsidies. Distributional analysis plays a critical role in energy subsidy reforms by revealing who benefits from existing subsidies and how the reform of these subsidies, through restructuring or removal, could affect households across the income distribution. A series of well-developed distributional analysis methodologies can help policy makers assess the direct and indirect effects of energy subsidies and their reform. This report reviews the main methodologies for poverty and distributional analysis of energy subsidy reforms. To illustrate applications of established methodologies and explore real-world challenges encountered, the report presents four reform examples for which the World Bank, through technical teams that used ESMAP funding for analytical and advisory work, supported government counterparts in assessing the distributional impacts of energy subsidy reform. This section summarizes some of the main insights and lessons from this review on methodological and policy dimensions that may be useful for policy makers and development practitioners.

Energy price subsidies are an inefficient way of supporting the poor as they tend to disproportionately benefit the better-off households. As illustrated in the case studies on Ukraine and Indonesia, distributional analyses revealed that a significant share of the pre-reform subsidies was accruing to wealthy households. In Ukraine, before the reforms, the richest quintile received up to 35 percent of district heating subsidies, whereas the poorest quintile received about 11 percent. In Indonesia, the richest quintile received 42 percent of total energy subsidies, and the poorest decile received only 8 percent, mainly because gasoline subsidies accrued mostly to the rich.

Understanding how different reform options may affect various groups of households, and the poorest in particular, is critical and can support the design of potential mitigation mechanisms and measures at an early stage. Despite the regressivity of most energy subsidies, their removal, and subsequent energy price increases, can have substantial impacts on households at the lower end of the income distribution, especially when energy subsidies equate to a significant share of overall household expenditure. For instance, according to the simulations carried out before the reform in Ukraine, the projected tariff increase scenario that would eliminate gas and district heating subsidies would have significantly increased the poverty headcount in the absence of mitigation measures (all else remaining equal). With the introduction of mitigation measures through the dedicated HUS program, the estimated poverty headcount increase was reduced by more than half. In addition to the impact on poverty rates, affordability of energy for current and future users is a relevant issue in a range of contexts, for example, where energy consumption is high before a reform and energy price increases aggravate energy poverty (typically for heating as in Ukraine and Uzbekistan), or where a substantial share of the poor do not yet have access to electricity, as in Sub-Saharan Africa, but are expected to gain access in the medium term. As shown for the electricity subsidy reform in Guinea, affordability of energy bills for the poorest households needs to be considered when the revised tariff is designed in anticipation of network expansion. In addition to the direct impacts of energy price increases, the reforms can affect poor households indirectly through increases in the costs of other goods and services, for which energy is used as an input and price increases could be partially or fully translated into changes in the prices of final goods and services. This is particularly true for reform of fuel subsidies, where the indirect effects through impacts on other goods often account for more than half of the total effect, as in Indonesia. Total energy subsidies (direct and indirect) were the equivalent of up to 10 percent of the market income of the poorest households in 2012; thus, their reform (partial removal and restructuring) must consider affordability issues for the poorest and use fiscal savings to further develop inequality-reducing tools.

Distributional analysis is an essential tool that can enable substantially improved understanding of potential reform impacts and help strengthen reform design, and can be carried out using a range of approaches suitable for different contexts. The cases reviewed in this report illustrate the use of various approaches in real-world reform efforts. The Guinea and Indonesia cases illustrate the use of limited general equilibrium approaches that have been deployed to evaluate the direct and indirect effects of energy subsidy reforms. In these cases, direct effects on households were simulated using household survey and energy expenditure data, and the assessment of indirect effects required input-output matrixes covering all economic sectors. In the analysis carried out in Indonesia, energy subsidies were evaluated as part of a broader fiscal incidence assessment using the CEQ methodology. The distributional analysis conducted in Ukraine is a good example of an in-depth distributional analysis of the direct effects on households of an unprecedented energy price increase and incorporation of options for mitigation measure into the analysis to inform the design of the reform itself. Finally, other methods can be used when conventional quantitative methods are not sufficient; for example, in Uzbekistan, qualitative studies were used to gather supplemental information on actual usage and practices as well as attitudes toward energy affordability and reforms with a specific focus on the low-income and vulnerable population most likely to be affected.

Along with understanding the distributional *incidence*, more indicators are necessary to assess the distributive *impact* of the reform on households, especially where energy affordability and poverty are significant issues. According to the review of targeted poverty alleviation policies in developing countries, Lavallee et al. (2010) show that most commonly used indicators provide little information on the poverty reduction impacts of the different targeting methods and that it is vital for targeting methods to be compared in light of their contribution to the end goal of poverty alleviation policies. Additional indicators include the affordability of energy as a share of total expenditure and the coverage of the subsidy, as in Ukraine. The latter is important because a perfectly progressive distribution does not protect against the exclusion of poor households,[56] nor welfare loss or poverty increase following the price increase, thus distributive impact assessments are much wider than the distribution of the subsidies itself.

[56] The HUS program was assessed to have built-in exclusionary biases. To qualify before the reform, households needed both low income and high bills, thereby excluding poor rural households who might not be connected to either district heating or gas. Households depending on other heating sources, such as coal or wood, could resort to other forms of support, mostly centered on direct fuel supply. Such programs have been far less generous than the HUS (Ruggeri Laderchi et al. 2019).

Choice of distributional analysis approach should be guided by sector context, reform objectives, and realities on the ground. Practitioners considering distributional analysis in the context of energy subsidy reforms need to invest time to understand the reform context, assess the reform objectives, evaluate data availability, and accordingly choose the analytical tool that best fits their needs. Once that choice is made, the analytical approach can be customized to the context. First, the distributional analysis approach has to be adapted to the country and sector context and may require combining different sources of information and methods to ensure the assessments are fit for purpose and can generate useful insights. Second, recognizing that the quality and completeness of distributional analysis is highly dependent on data availability and underlying assumptions is critical. Finally, having the right skill set on board and combining it with diverse technical expertise is critical for a sound distributional assessment. These points are explored further below.

Aligning analytical approach and calibrating the tools to match the context is important. Understanding potential impacts from reforms may require combining diverse sources of information and methods. For example, as noted earlier, the implications of reforming subsidies for energy delivered through networks or for liquid fuels are different. The assumptions of the analysis should be guided by the type of energy source and market conditions. For liquid fuels, the price paid by consumers may be different than the official price and, if unknown, could alter the results of the assessment. For network energy, prices might differ between households, but most important, actual energy consumption may be hard to estimate because of either seasonality (in Ukraine, estimations were conducted for the heating and nonheating seasons separately, and in Uzbekistan, focus groups underlined the seasonality issue of financial hardship) or unmetered consumption, shared meters, and illegal connections as in Guinea. In this latter case, the analysis would need to consider selected energy consumption bundles to avoid arbitrary assumptions about actual consumption.

The country cases reviewed indicate that even when well-developed methodologies are available, the quality and completeness of distributional analysis for energy subsidy reform is highly dependent on data availability and underlying assumptions. Results are sensitive to the design, assumptions, and limitations of the simulation models. The modeling effort must be fully transparent to allow practitioners and decision-makers to be aware of its limitations so they can avoid overinterpreting results when assumptions or data are not reliable or may have changed. For example, in the estimation of indirect effects, if the model keeps certain technical coefficients fixed, the possibility of fuel substitution is disregarded. As a result, indirect effects of fuel price increases would be overestimated and correspond only to short-term effects. Another challenge comes from the common assumption that fiscal or quasi-fiscal energy subsidies are fully government funded and could be translated into social transfers once eliminated. This is not always the case. In Indonesia, not all energy subsidies were channeled through the budget because such levels of government expenditures for energy are not legally authorized. This could partly explain why the funding for targeted social assistance remained low, and especially lower than in countries with similar income levels. When interpreting the results of qualitative surveys, recognizing the context, design, and limitations of the approach is critical, given that the objective of the study is to understand the perspectives of specific groups. Qualitative analysis can contribute to the government's toolbox of options for understanding, assessing, and evaluating potential distributional impacts and household perspectives, ideally in combination with quantitative methods to fully address the distributive issues of the reforms.

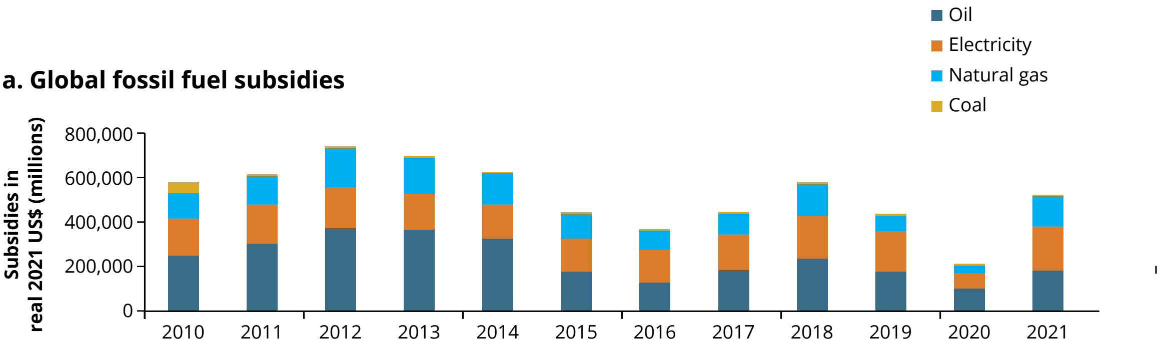
Review of recent experience shows that having the right skill set on board and fostering collaboration among experts with diverse technical expertise is critical for a sound distributional assessment of a reform initiative under consideration. This holds true for both government officials tasked with designing the reform and for technical advisors supporting them, be they through the World Bank or other development partners. The cases reviewed for this report reveal that when a distributional assessment is carried out by a team of experts that comprises multiple skill sets, such as in energy, poverty, macroeconomics, and social protection, the quality of the underlying assumptions and modeling, and the relevance of its findings and resulting recommendations, can be enhanced. This reflects the recognition of the breadth and depth of knowledge that is critical for properly assessing and mitigating the impact of reform options under consideration—including understanding energy sector cost-recovery pathways, the macroeconomic outlook, transmission channels for price increases, and possible mitigation measures.

Appendix A

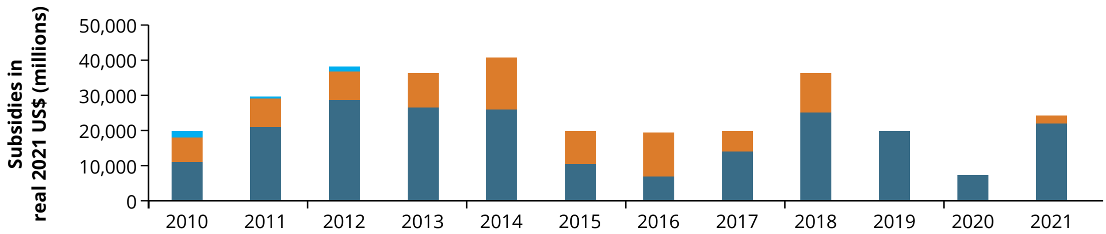
FIGURE A.1

IEA Data on Fossil Fuel Subsidies in Select Countries (Price Gap Approach)

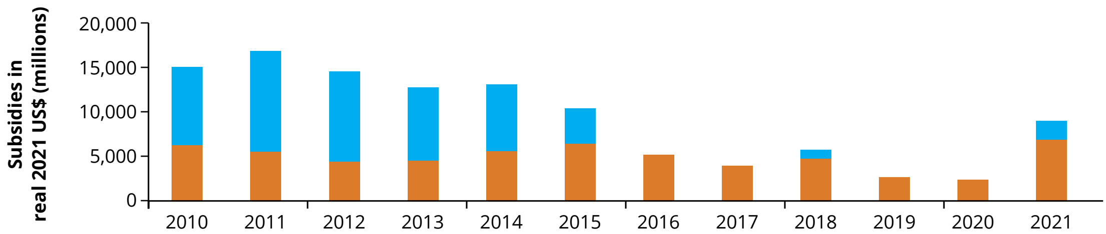
a. Global fossil fuel subsidies



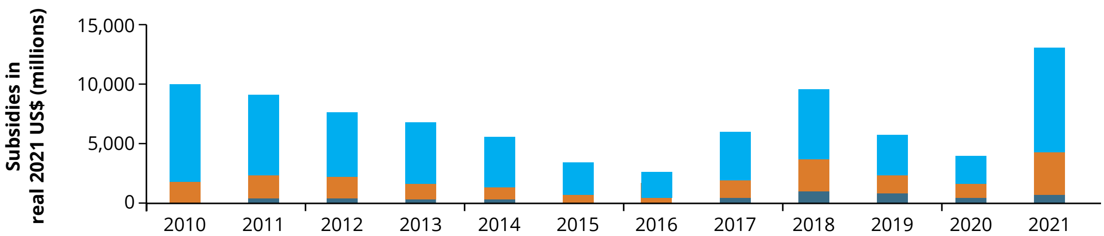
b. Indonesia



c. Ukraine



d. Uzbekistan



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